Central Coast Juvenile Herring Survey, August 2007

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Nanaimo, British Columbia
V9T 6N7

2009

Canadian Manuscript Report of Fisheries and Aquatic Sciences 2867

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by

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Cat. No. 97-4/2867E ISSN 0706-6473

Correct citation for this publication:

Thompson, M., and Therriault, T.W. 2009. Central Coast juvenile herring survey, August 2007. Can. Manuscr. Rep. Fish. Aquat. Sci. 2867: vi + 53 p.

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ABSTRACT

Thompson, M., and Therriault, T.W. 2009. Central Coast juvenile herring survey, August 2007. Can. Manuscr. Rep. Fish. Aquat. Sci. 2867: vi + 53 p.

In 2007, a Central Coast juvenile herring survey was conducted from August 10-22. Sixty-five sets were made at 13 locations within Statistical Management Areas 6, 7, 8 and 9. The study area extended from Meyers Passage in the north to Rivers Inlet in the south. The survey serves to address information gaps on the distribution, abundance, size and feeding habits of juvenile herring in these nearshore, northern waters.

Sixteen species of fish were identified in all purse seine catches with herring being the most frequently encountered species. A total of 6710 herring were measured resulting in a length frequency distribution that was distinctly bimodal representing age-0+ and age-1+ fish. Age-0+, age-1+ and age-2+ or older herring occurred in 72.3%, 92.3% and 24.6% of the sets, respectively. Two oblique plankton tows were performed at each of the 13 locations for a total of 26 tows during the survey. Mixed juvenile calanoid copepods and cladocerans (*Podon sp.* and *Evadne sp.*) occurred in all samples and *Acartia longimeres*, mixed euphausiid and teleost eggs occurred in the largest quantities. Twenty-six CTD casts also were performed during the survey to document oceanographic conditions.

RÉSUMÉ

Thompson, M., and Therriault, T.W. 2009. Central Coast juvenile herring survey, August 2007. Can. Manuscr. Rep. Fish. Aquat. Sci. 2867: vi + 53 p.

En 2007, une campagne de recensement portant sur les stocks de harengs juvéniles de la partie centrale de la côte a été effectuée entre le 10 et le 22 août. Au total, 65 traits de senne ont été effectués à 13 endroits différents des zones de gestion statistiques 6, 7, 8 et 9. Le secteur couvert s'étendait du passage Meyers, au nord, à l'inlet Rivers, au sud.

En tout, 16 espèces de poissons ont été dénombrées dans les ponctions effectuées, le hareng étant l'espèce la plus souvent représentée, et 6 710 harengs ont été mesurés. Les résultats indiquent une distribution nettement bimodale de la fréquence des longueurs, représentant la prédominance de la cohorte 0+ et de la cohorte 1+. Les harengs des classes d'âge 0+, 1+ et 2+ et plus étaient présents à des taux de 72,3 %, 92,3 % et 24,6 % respectivement. Deux traits obliques de filets à plancton ont été effectués à chacun des 13 endroits, pour un total de 26 traits. Un mélange de copépodes calanoïdes juvéniles et de cladocères (*Podon* sp. et *Evadne* sp.) était présent dans tous les échantillons, alors que *Acartia longimeres*, un mélange d'euphausiacés et des œufs de téléostéens étaient les organismes les plus nombreux. Enfin, 26 sondages de CTP ont été effectués en concomitance avec les opérations de recensement, pour documenter les conditions océanographiques.

INTRODUCTION

Pacific herring (*Clupea pallasi*) are an important commercial species and a vital forage species for many marine mammals, birds and other fish in British Columbia's coastal waters. Herring spawn principally on marine vegetation in the subtidal and upper intertidal zone between February and June, with peak spawning between March and April (Humphreys and Hourston 1978). Larvae hatch in two to three weeks, and disperse with surface currents, metamorphosing into juvenile herring at a length of ~25mm (Hourston and Haegele 1980). Juvenile herring consist of two distinct age classes, 0+ and 1+, with recruitment for this species occurring at age 3 when they join the sexually mature spawning population (Hay and McCarter 1999). During daylight hours, juvenile herring congregate in schools, occasionally forming mixed aggregates with other pelagic species, close to shore near the bottom (Haegele 1997). At dusk, these fish migrate into surface waters to feed on plankton. During this time they are vulnerable to purse seine gear.

Relatively little is known about the distribution, abundance, size and feeding habits of juvenile herring in the Central Coast of British Columbia (Figure 1). In 2002-2004 and 2007, juvenile herring surveys were designed to address information gaps and learn about the general biology of herring in this northern geographical area. The survey used an ecosystem based approach to biological sampling. Therefore, in addition to juvenile herring, all other fish species were retained for analyses. Also, plankton samples and oceanographic data samples were collected. This approach will potentially provide a better understanding of the role and relationships juvenile herring have in Central Coast waters, and may provide an empirical forecast of recruitment to the herring roe fishery based on relative juvenile abundance.

METHODS

In 2007, the Central Coast juvenile herring survey was conducted from August 10-22. Sixty-five sets were made at 13 locations within Statistical Management Areas 6, 7, 8, 9 and 10 (Table 1). The study area extended from Meyers Passage in the north to Rivers Inlet in the south (Figures 2 and 3). The 2007 set locations followed 2002, 2003 and 2004 surveys (Henderson et. al. 2004, 2005 and Thompson and Therriault 2006). Spider Anchorage (set code 3) was removed as a sampling location and Dean Channel (set code 13) and Rivers Inlet (set code 14) were added as new locations. In previous years, we only performed 1 to 4 sets per location for a total of 38, 39, and 32 sets for 2002, 2003 and 2004 surveys respectively. In 2007 we added sets within each location to perform five sets per night for a total of 65 sets. The sampling sites originally were chosen based on known historical herring spawning sites, and represent both nearshore and open water habitats (Haegele and Armstrong 2003).

Fish Sampling

The 12m, aluminium-hulled Fisheries Research Vessel *Walker Rock* was used for all fishing events. A 183m long and 27m deep purse seine net of knotless web, resulting in an area fished of ~2665m^2, was used for all fishing events. The body of the net had 46m of 22.2mm mesh at the tow end followed by 91m of 19.0mm mesh, and the bunt end was 46m of 9.5mm mesh. The net fished to a depth of 10m, and was able to retain fish greater than 20mm in length. All sets were made after dusk when herring are feeding near the surface. All sets were made "blind" at predetermined set locations. Five sets were completed per night for all locations. No proposed sets were lost due to adverse weather or oceanic (tide) conditions. For most sets, it was possible to land the entire catch for biological sampling. On occasion, it was not practical to land a large set in its entirety, so sub-sampling was necessary. When sub-sampling was required, a herring bucket was filled with randomly selected fish and retained for biological sampling. Several dipnet samples from various parts of the net (catch) would be used to make up the random sub-sample. The remainder of the set was released over the corkline, its size estimated as the number of buckets released. The number of herring caught in each set was determined by multiplying the sub-sample herring weight and number into the number of estimated buckets released (total catch). The number of other species caught in the sub-sample was determined in the same manner (Table 2). All fish retained for sampling were weighed, bagged and preserved in a 3.7% seawater formalin solution, with the exception of large predator species (e.g., adult salmon, dogfish and mackerel). These fish were individually weighed and measured in the field. Retained samples were taken back to the Pacific Biological Station for laboratory analysis.

From each set, 100 or more herring from each represented age-class and all other fish species caught were identified, weighed and measured. If the set contained less than 200 herring, then all herring were weighed and measu . Consistent with standard practices, herring were measured to standard length; salmon to fork length; dogfish, hake and pollock to total length. All other fish species were measured to standard length.

Plankton Sampling

Twenty-five stepped oblique plankton tows were performed during the survey (Figures 4 and 5). Two plankton samples were taken from each location, one sample "nearshore" and the other "offshore or channel". The tows always were completed after dusk and immediately before fishing events. Dual 19cm diameter bongo nets with 350μm mesh were used for sampling, resulting in 'left' and 'right' bongo plankton samples (only left samples were processed). The bongos were lowered to 20m and raised by an electric winch at a rate of 1m every 15 seconds. A General Oceanics® 2030R model flowmeter was attached to the left bongo to determine the volume of seawater filtered. Volume filtered was calculated using the following equation (McCarter and Hay 2002):

$$\mathbf{V = (A \cdot F \cdot K) / 999{,}999}$$

Where:

V = volume of water filtered through the plankton net (m^3)
A = area of net opening ($0.02835m^2$)
F = number of revolutions recorded by the flow meter (m)
K = standard speed rotor constant for 7cm rotor (26,873)

Upon retrieval, the bongo nets were washed with a high pressure deck hose, and the samples preserved in 3.7% seawater formalin.

In the laboratory, a volumetric splitter was used to reduce the sample size to a point where organisms could be conveniently counted and identified in a counting tray using a stereo microscope under 30X magnification. Sample splitting continued until a target size of roughly 300 organisms was reached (Thompson et al. 2003).

When possible, plankters were identified to the lowest taxonomic level. Copepods were identified to species. Densities for all plankters were determined and expressed as plankters $\cdot m^{-3}$.

CTD Sampling

To characterize oceanographic conditions in the surveyed area, a total of 26 CTD (conductivity – temperature – density) casts were made using a RBR XR-620 (Figures 4 and 5). Two CTD cast was performed at each location before plankton sampling. The CTD unit was weighted and lowered over the side of the vessel to within a few meters of the bottom to give the largest water profile as possible. Descent rate of the CTD is close to 1m/sec. Data was downloaded to a laptop computer from the CTD unit after each evenings casts.

RESULTS

Sixty-five sets were made during the 2007 survey; five in section 101 (Rivers Inlet), five in section 091 (Fish Egg Inlet), five in section 085 (Kwakshua Channel), five in section 076 (Kildidt Sound), five in section 074 (Thompson Bay), ten in section 067 (Kitasu Bay and Meyers Passage), five in section 077 (East Higgins Pass), ten in section 072 (Powell Anchorage and Spiller Channel), five in section 073 (Hunter Channel) and five in section 084 (Burke Channel) and five in section 081 (Dean Channel). Most of 2007 set locations correspond to set locations used in the 2002, 2003 and 2004 Central Coast surveys (Figures 2 and 3, Table 1) with the addition of at least 26 new sets.

Sixteen species of fish and two invertebrate species were identified in the purse seine catches. The most frequently encountered species (>50% occurrence) included: Pacific herring and Pacific sardine (Tables 2 and 3).

Herring

A total of 6710 herring were measured resulting in a length frequency distribution that was distinctly bimodal. Based on this length frequency distribution (Figure 6), the length designations for the two juvenile herring age-classes are:

0+ = herring less than or equal to 80mm standard length
1+ = herring between 81mm and 140mm standard length
2+ and older = herring greater than or equal to 141mm standard length

Figure 7 shows length frequency histograms for all sampling locations. Burke Channel (set code 12) and Dean Channel (set code 13) show only age-1+ herring catches. It could be presumed that this type of geographical area of deepwater fjords is not ideal habitat for young-of-the-year herring. But catches during the 2008 survey did provide an abundance of age-0+ herring in these areas (authors' observations, paper in progress).

Age-0+ herring occurred in 47 of the 65 sets and made for a 72.3% occurrence (Table 3). No age-0+ herring were caught in Burke Channel (set code 12) and Dean Channel (set code 13). Table 4 shows the average length and weight for age-0+ herring, and the total herring catch weight at each set location. The mean length and weight of all sampled age-0+ herring (n=3157) was 56mm and 1.97g respectively.

Age-1+ herring occurred in 60 of the 65 sets and made for a 92.3% occurrence (Table 3). Table 4 shows the average length and weight for age-1+ herring, and the total herring catch weight at each set location. The mean length and weight of all sampled age-1+ herring (n=3430) was 108mm and 15.66g respectively.

Age-2+ herring occurred in 16 of the 65 sets and made for a 24.6% occurrence (Table 3). Table 4 shows the average length and weight for age-2+ herring, and the total herring catch weight at each set location. The mean length and weight of all sampled age-2+ herring (n=123) was 151mm and 45.78g respectively.

Herring length-frequency distributions varied by location. The histograms display the length frequency for sampled herring (Figure 7) but provide a representation of juvenile herring length distribution during the survey for each location. The relationship between length and weight for all sampled herring was determined by fitting a logistic function to the length-weight data (Figure 6). Thompson Bay, Dean Channel and Kitasu Bay sets resulted in the least amount of herring being caught in relation to total catch. Spiller Channel, Kwakshua Channel and Fish Egg Inlet sets resulted in the highest amount of herring being caught (Figure 9).

Plankton

There were 24 categories of organisms identified in 25 plankton samples (Tables 5 and 6). One sample from Thompson Bay (set code 5) had to be discarded due to the plankton

net filling up with jellyfish. Copepods occurred in all samples. *Pseudocalanus sp.* and cladocerans (*Podon sp.* and *Evadne sp.*) were the only organisms to occur in all samples. Barnacles, shrimp larvae, mixed euphausiid and teleost eggs, larvaceans (*Oikopleura sp.* and *Fritillaria sp.*), *Acartia longimeres*, *Centropages abdominalis*, crab zoea and euphasuiid larvae (*Euphausia pacifica, Thysanoessa spinifera, T. longipes and T. inspina*) occurred in >80% of samples (Table 7).

CTD

Two CTD casts were performed at each location before plankton sampling. The CTD provided a range of data for temperature (^{o}C), salinity (ppt), dissolved oxygen (%) and depth (m) (Figure 9). This is only the second year that CTD casts have been made; therefore, we have limited data for making broad observations on ocean conditions in our sampling areas.

CONCLUSION

Sixty-five stations were sampled resulting in 16 different fish species being recorded from the purse seine sets. A total of 6710 herring were measured and weighed creating a distinct bimodal histogram representing two juvenile herring age groups. Twenty-six plankton tows were performed with 25 plankton samples being processed. This resulted in *Pseudocalanus sp.* and cladocerans (*Podon sp.* and *Evadne sp.*) occurring in all samples and *Acartia longimeres* and *Pseudocalanus sp.* showing up in the largest quantities.

ACKNOWLEDGMENTS

This study was funded by Fisheries and Oceans Canada (DFO) along with vessel support and laboratory facilities. The research vessel was skippered by Don Houston. Don provides many years of valuable experience as a herring fisherman and knowledge of the Central Coast. Deck and mechanical work was performed by DFO biologist Charles Fort. All plankton samples were processed by Carol Cooper of Zotec Services.

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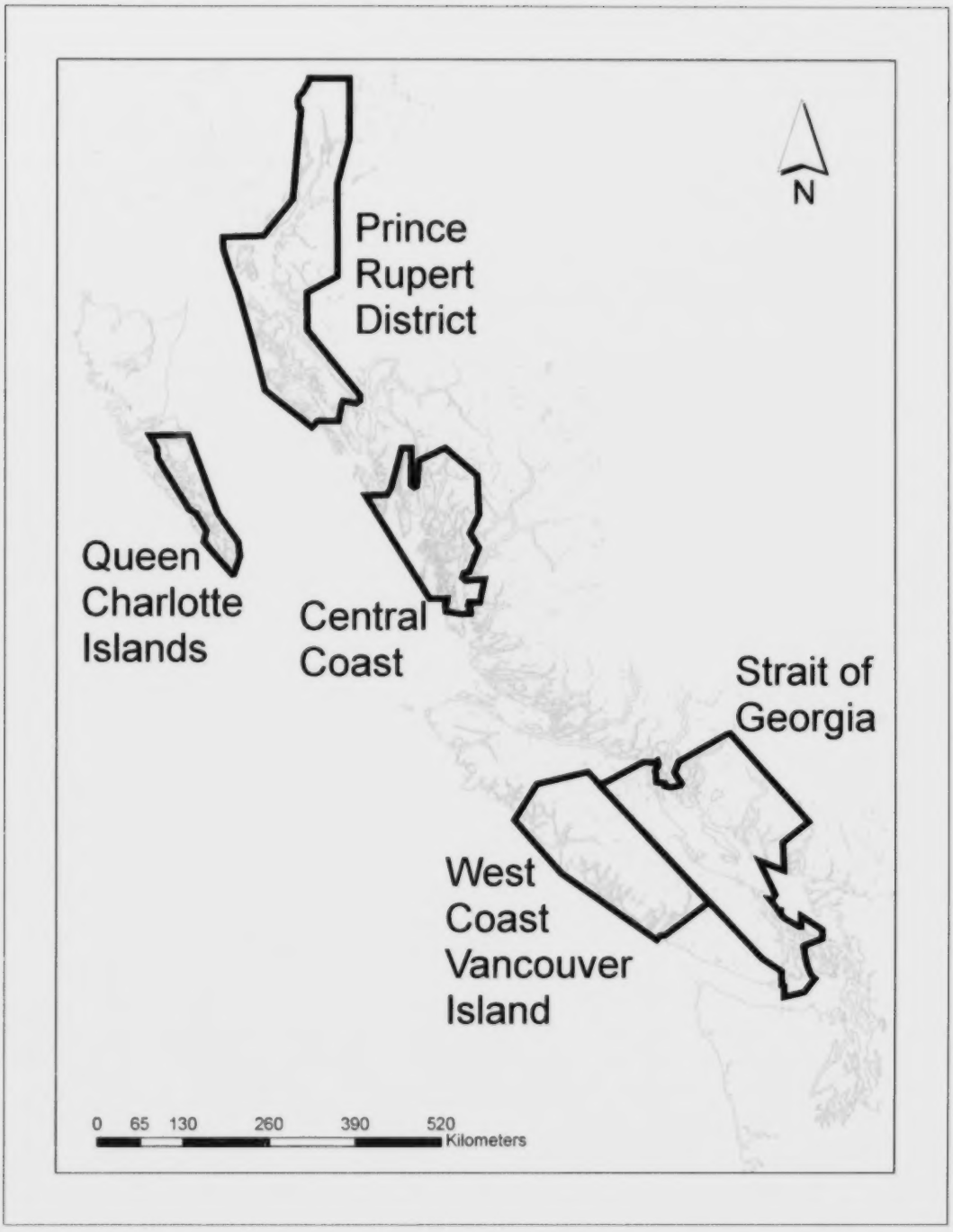


Figure 1. The five major British Columbia herring stock assessment areas with the Central Coast being the study area.

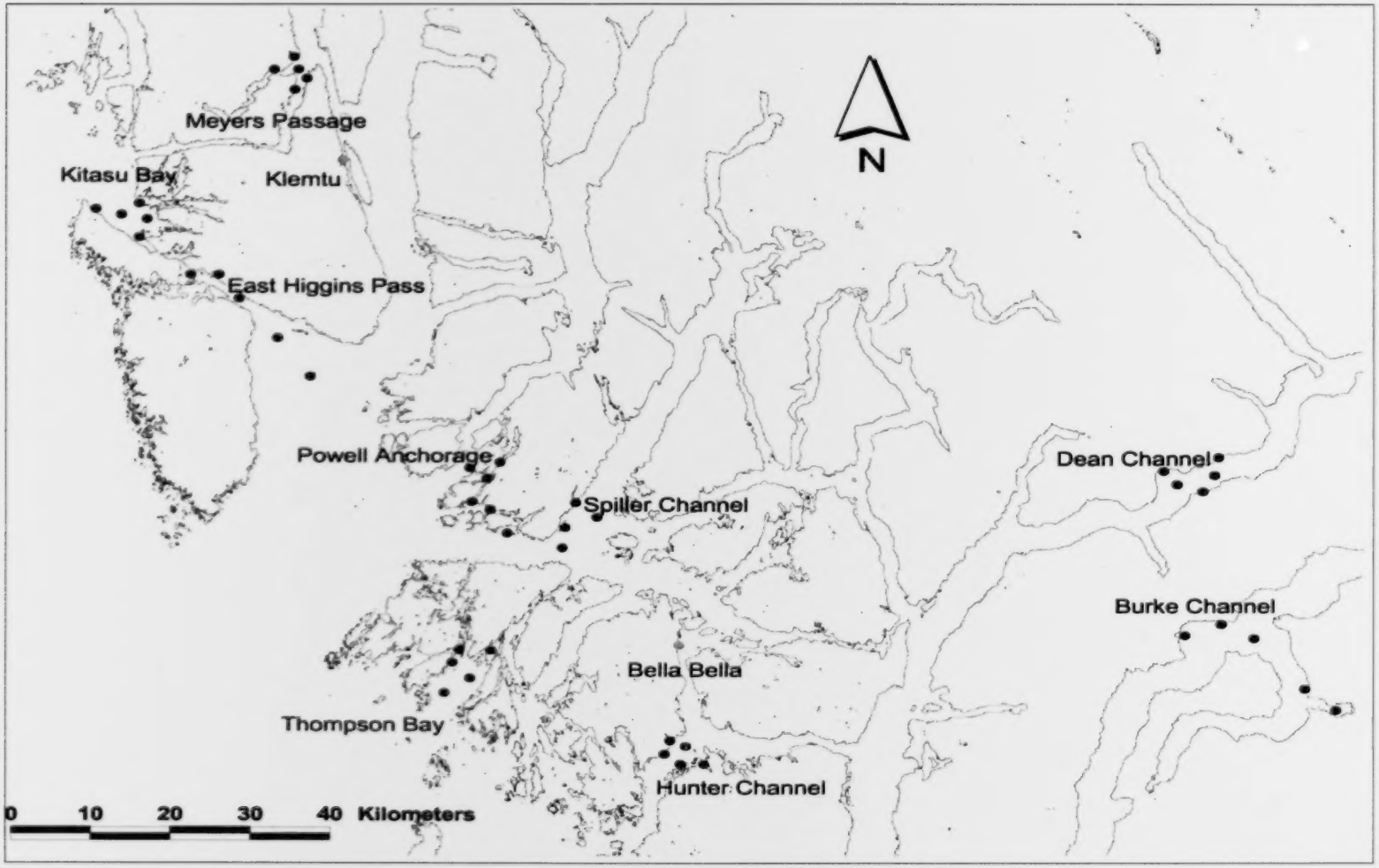


Figure 2. Upper purse seine set locations for the 2007 Central Coast juvenile herring survey.

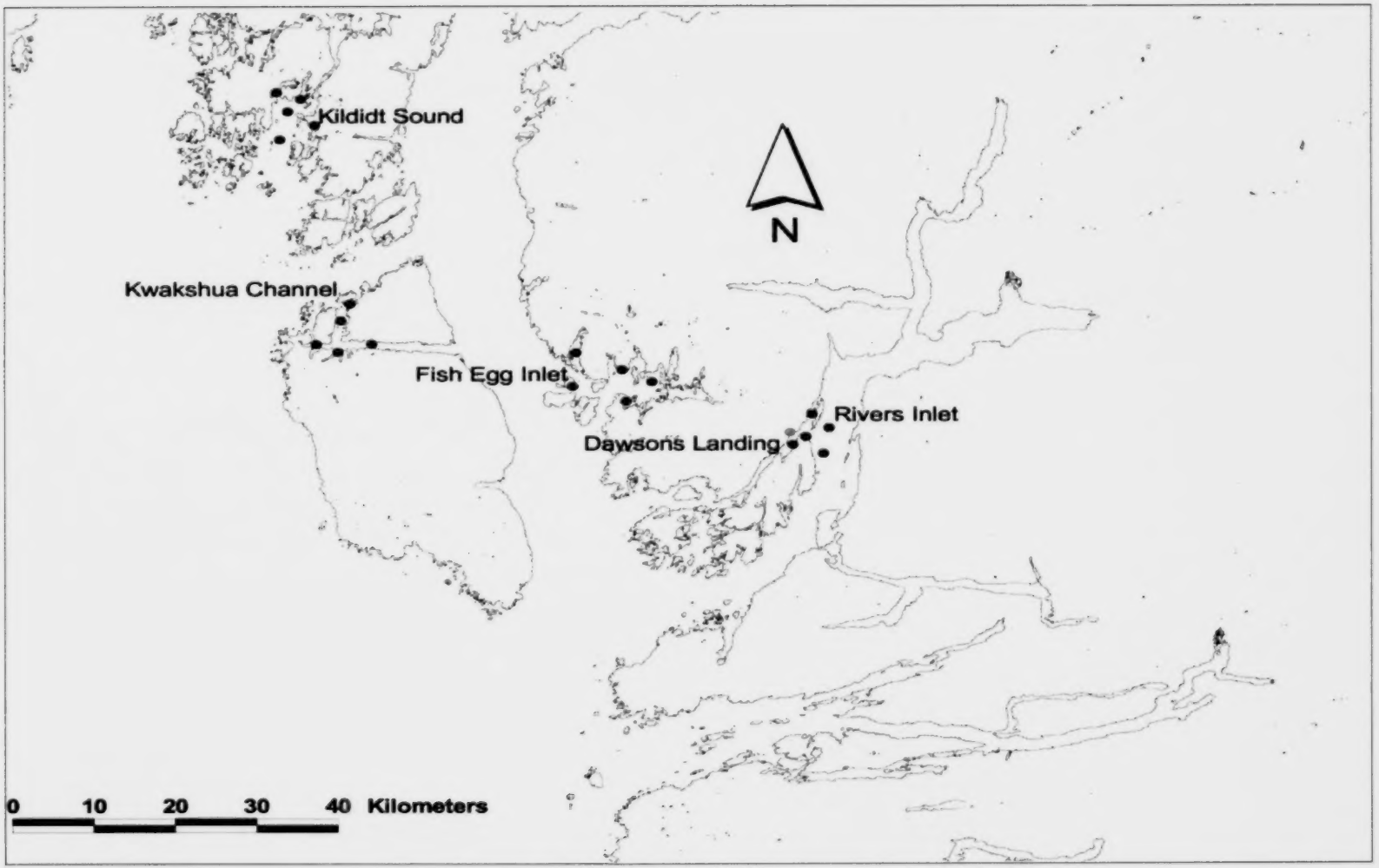


Figure 3. Lower purse seine set locations for the 2007 Central Coast juvenile herring survey.

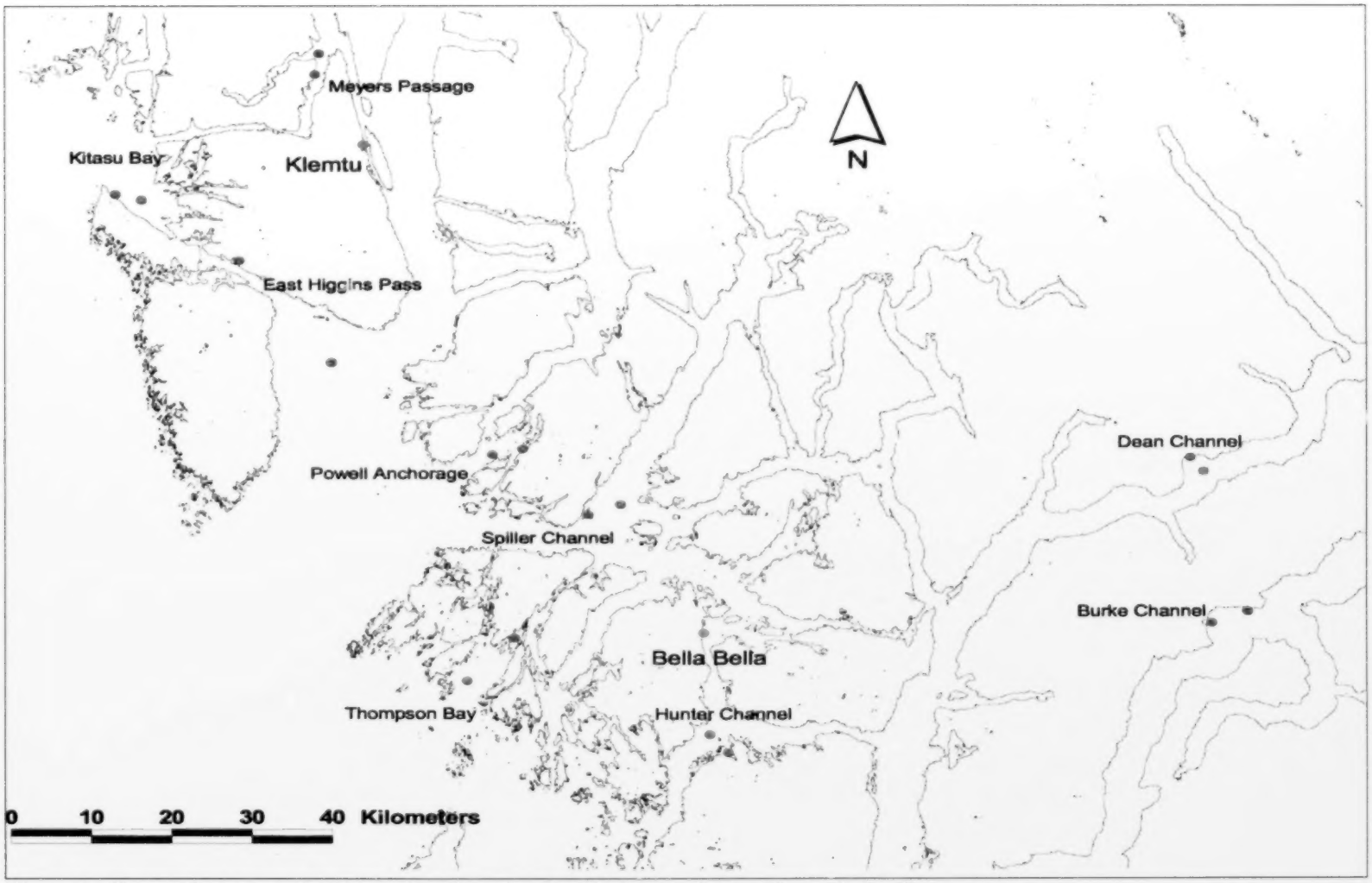


Figure 4. Upper plankton and CTD set locations for the 2007 Central Coast juvenile herring survey.

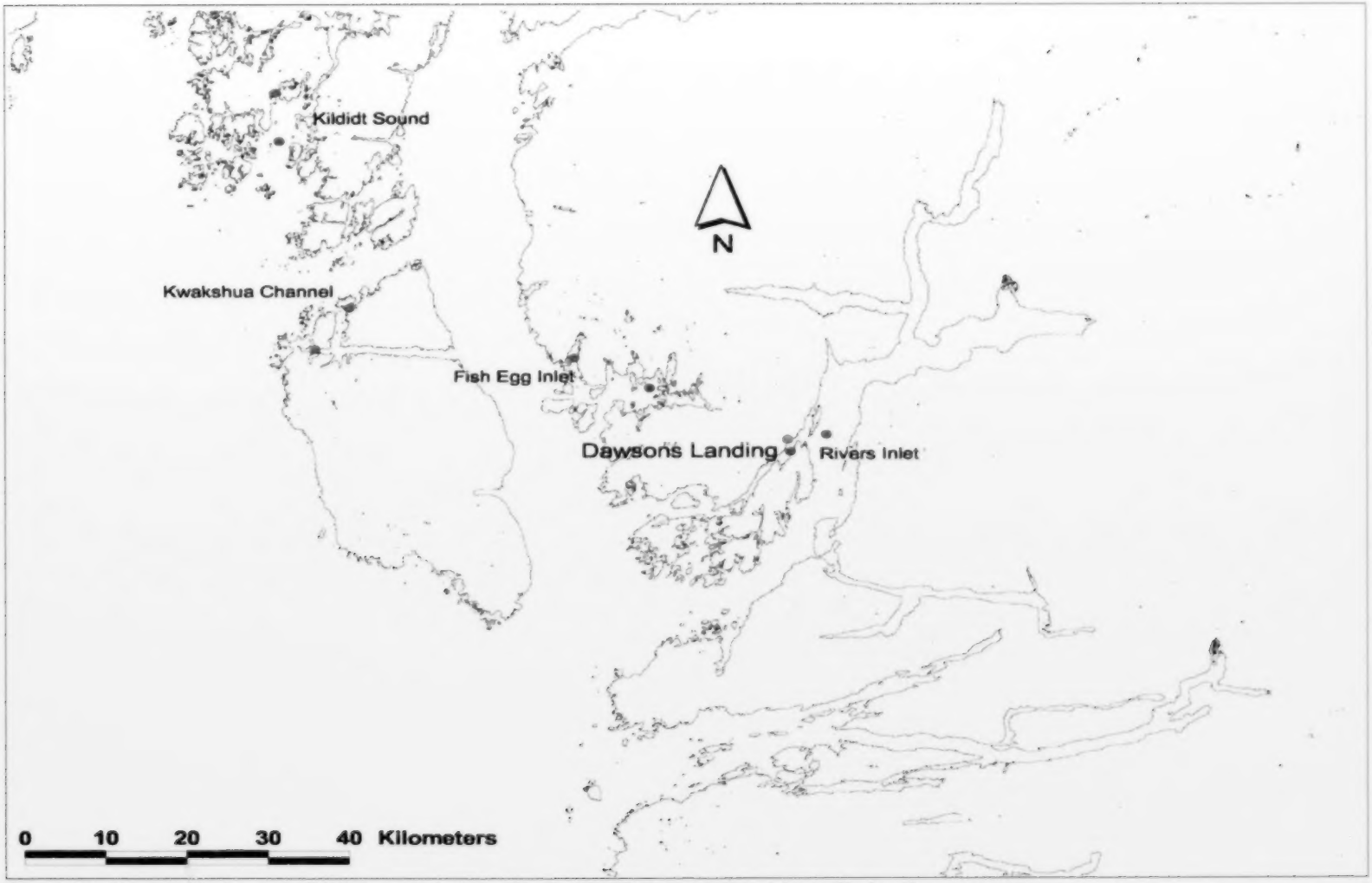


Figure 5. Lower plankton and CTD set locations for the 2007 Central Coast juvenile herring survey.

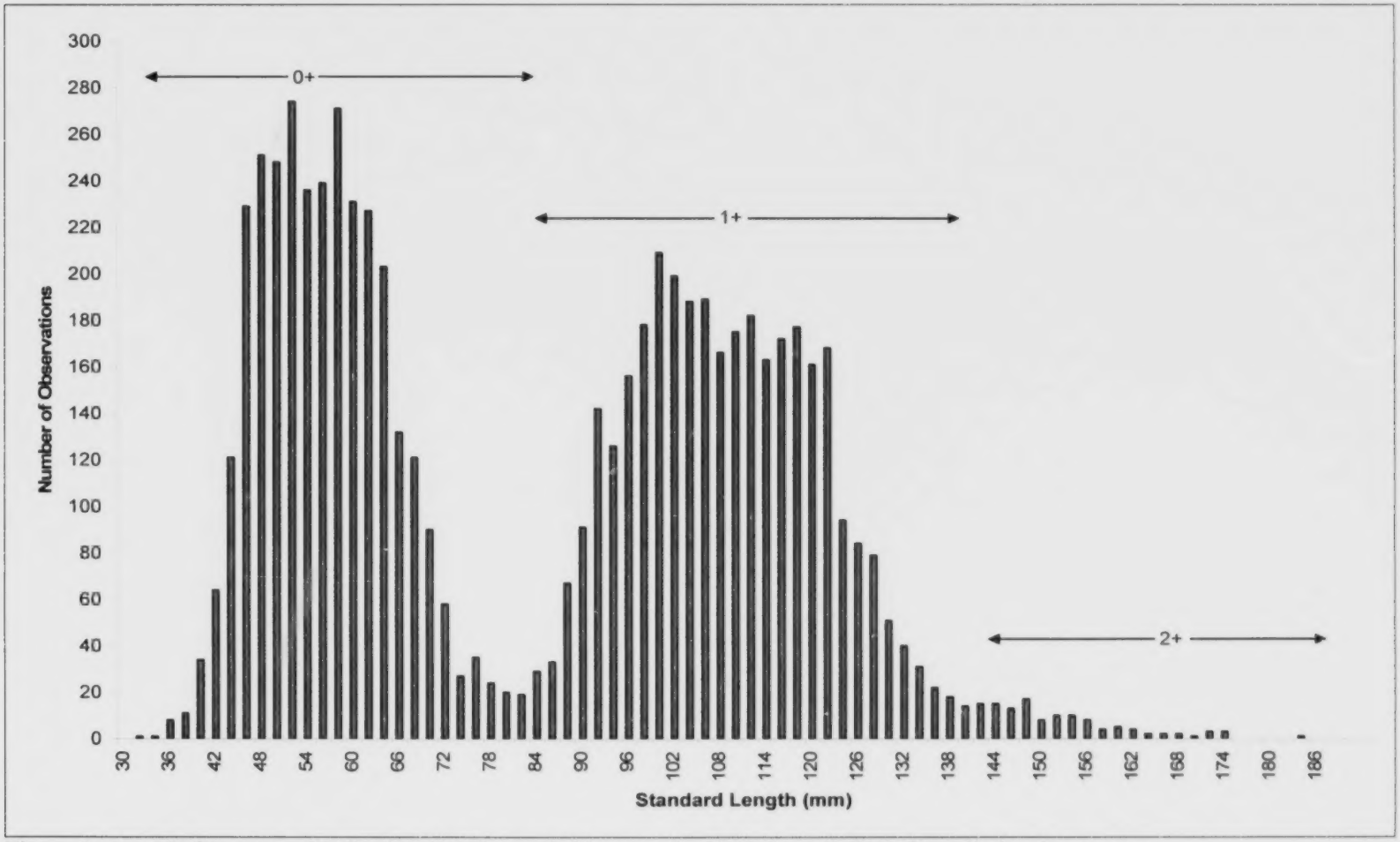


Figure 6. Length-frequency distribution for all sampled herring for 2007 Central Coast juvenile herring survey.

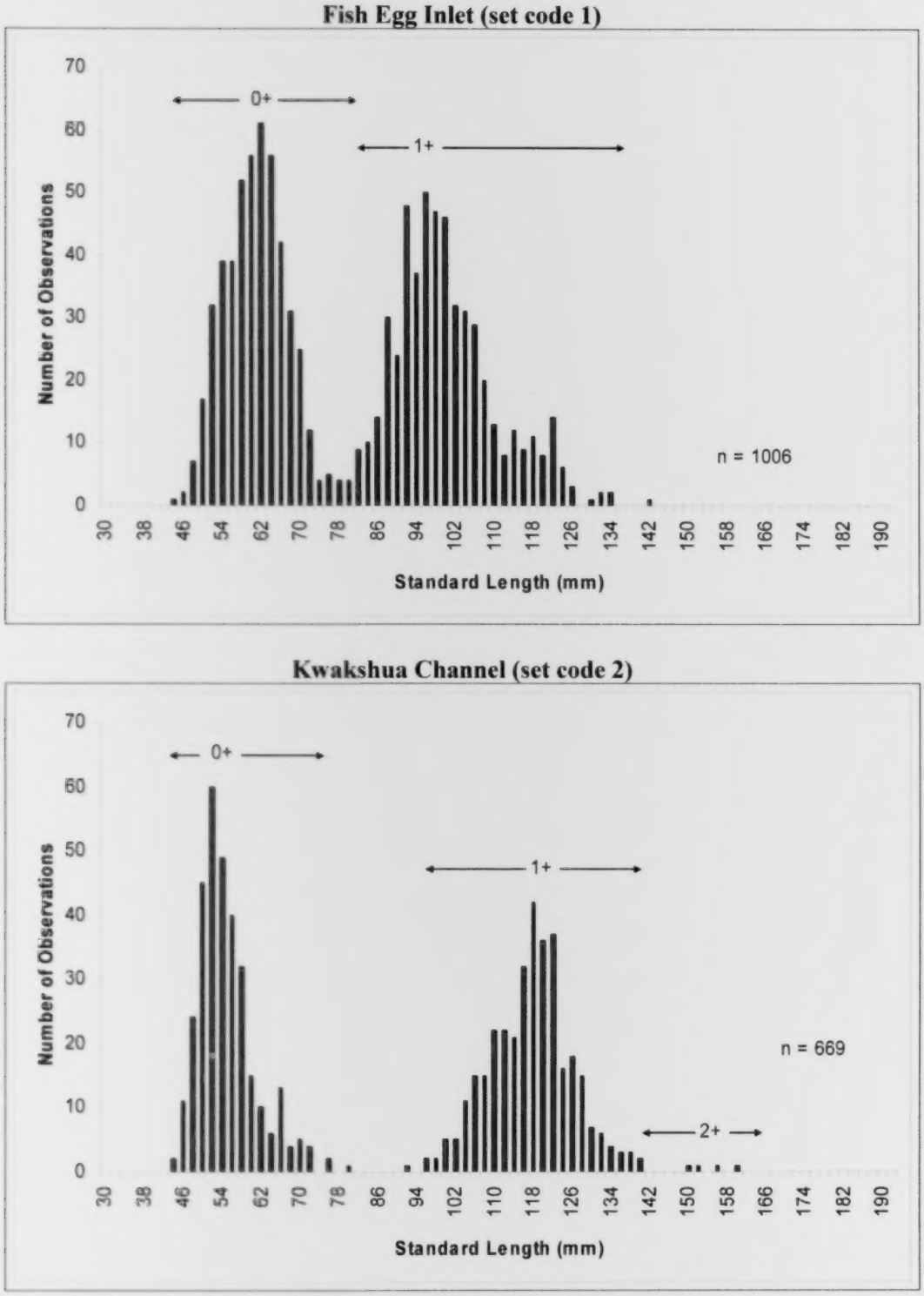
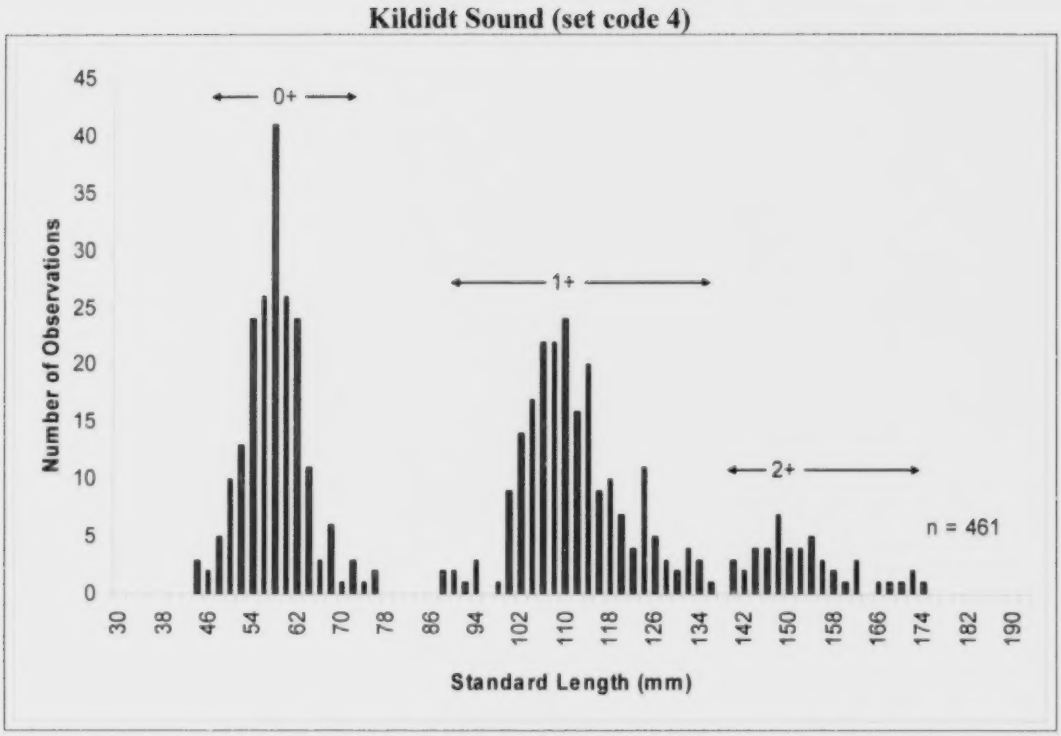


Figure 7. Length-frequency histograms by set code for the 2007 Central Coast juvenile herring survey.



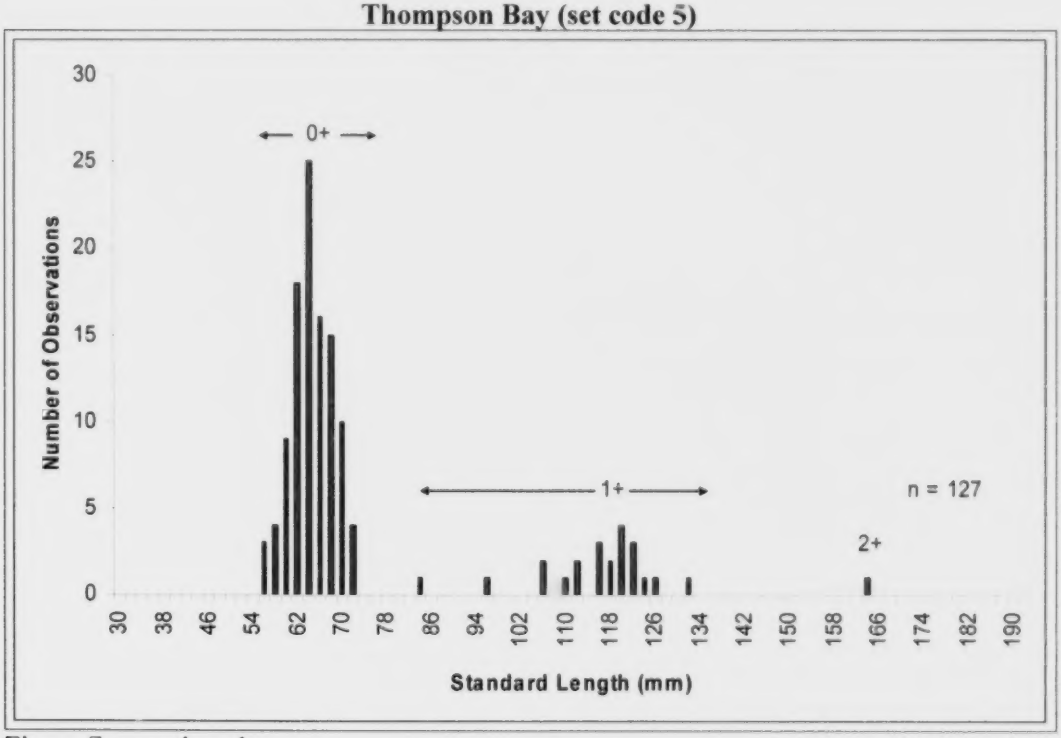
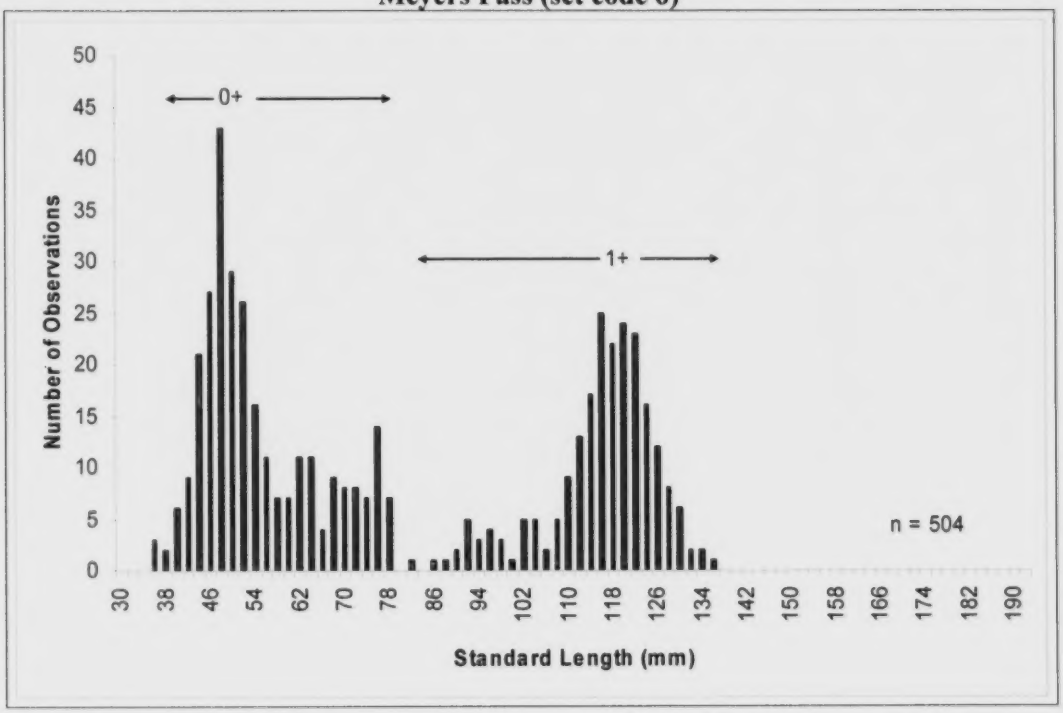


Figure 7…continued

Meyers Pass (set code 6)



Kitasu Bay (set code 7)

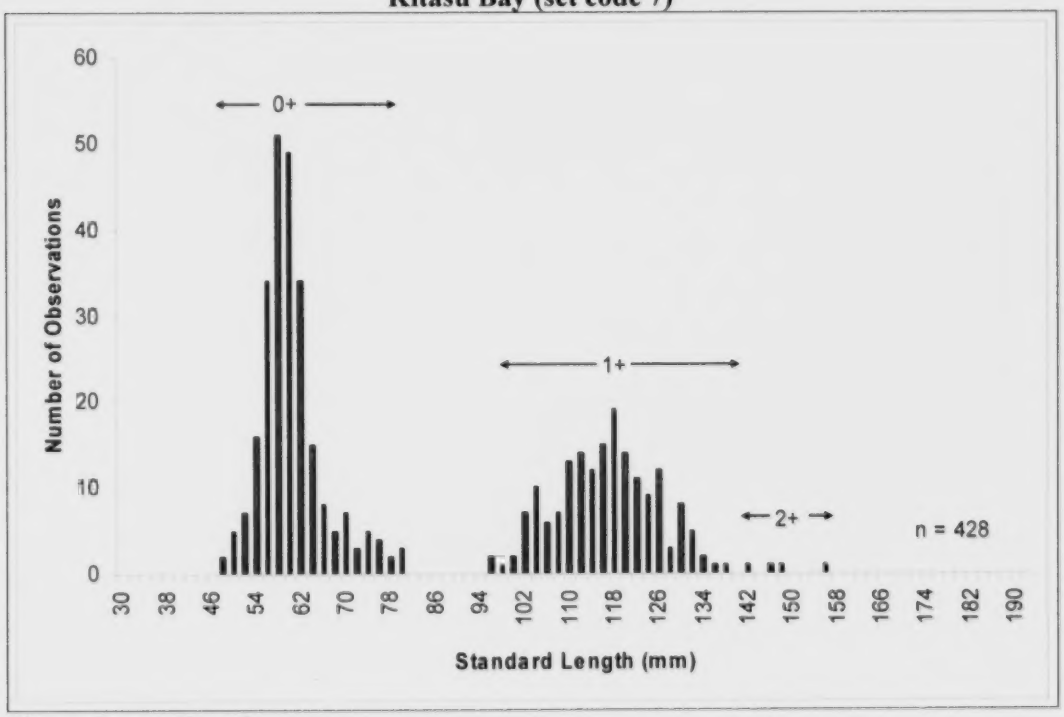
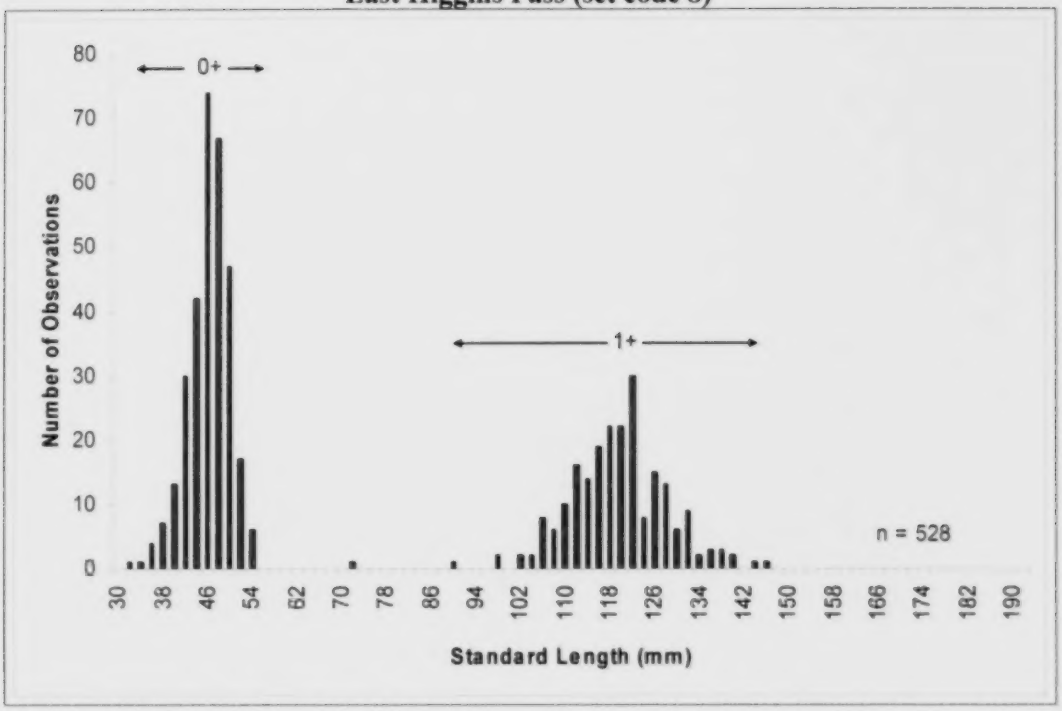


Figure 7…continued

East Higgins Pass (set code 8)



Powell Anchorage (set code 9)

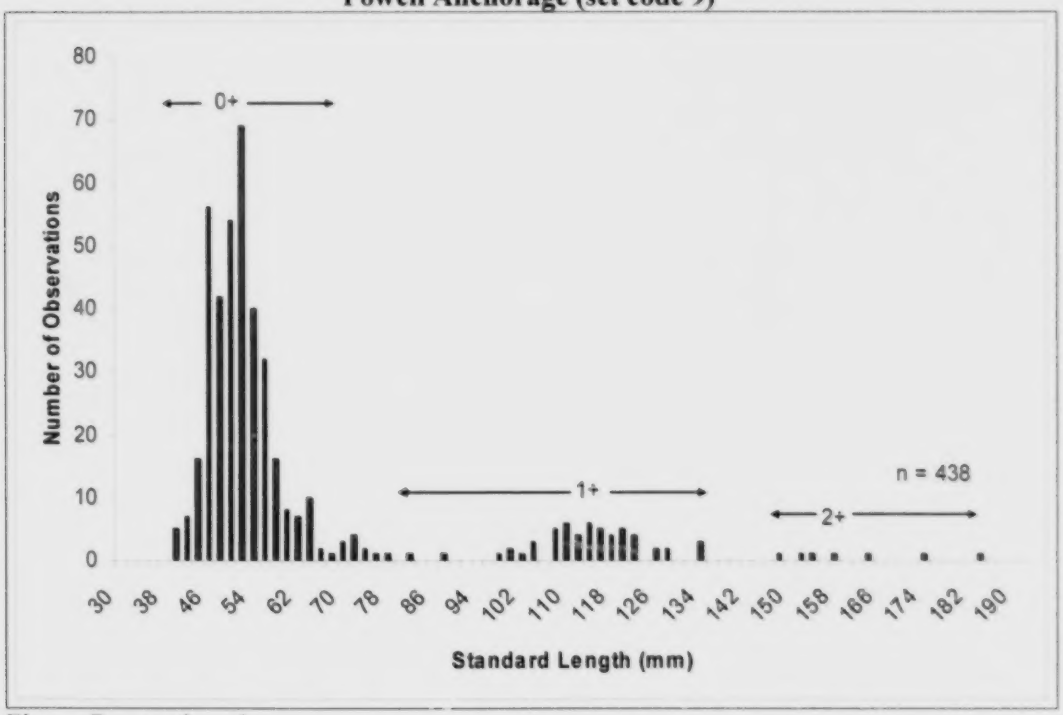
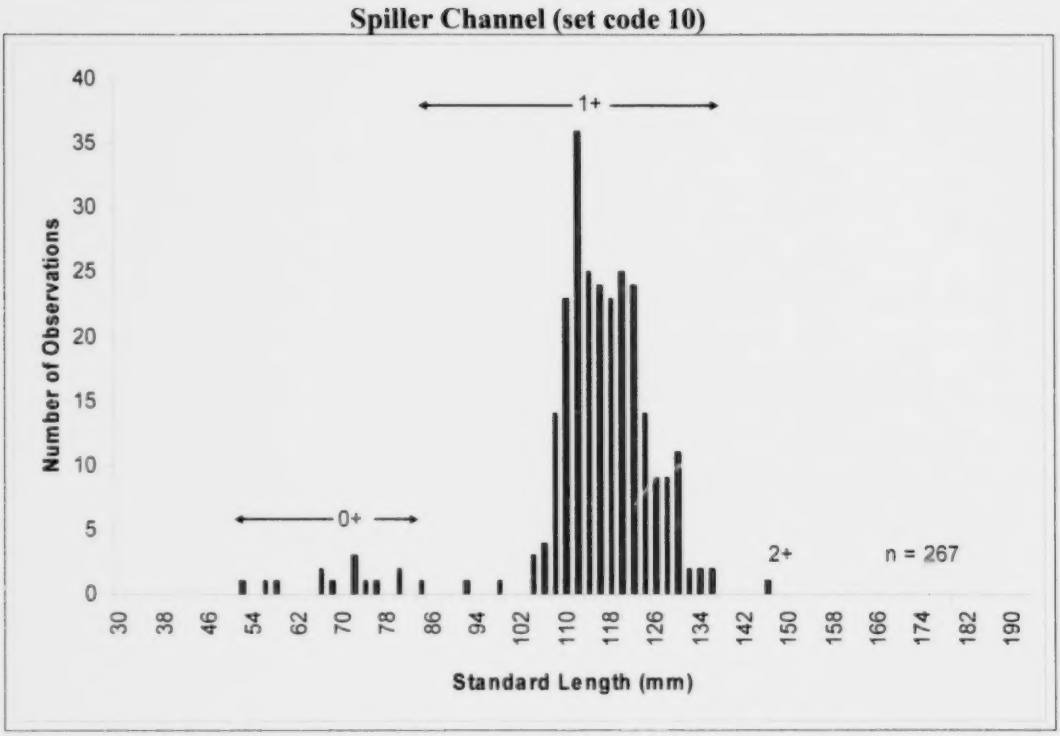


Figure 7...continued



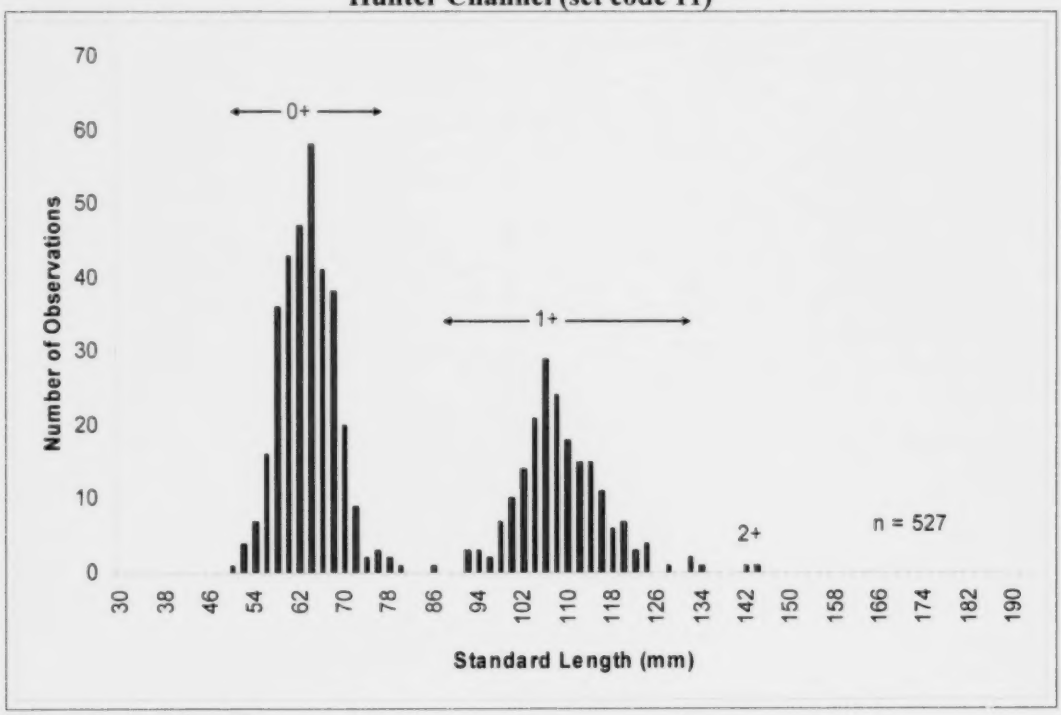
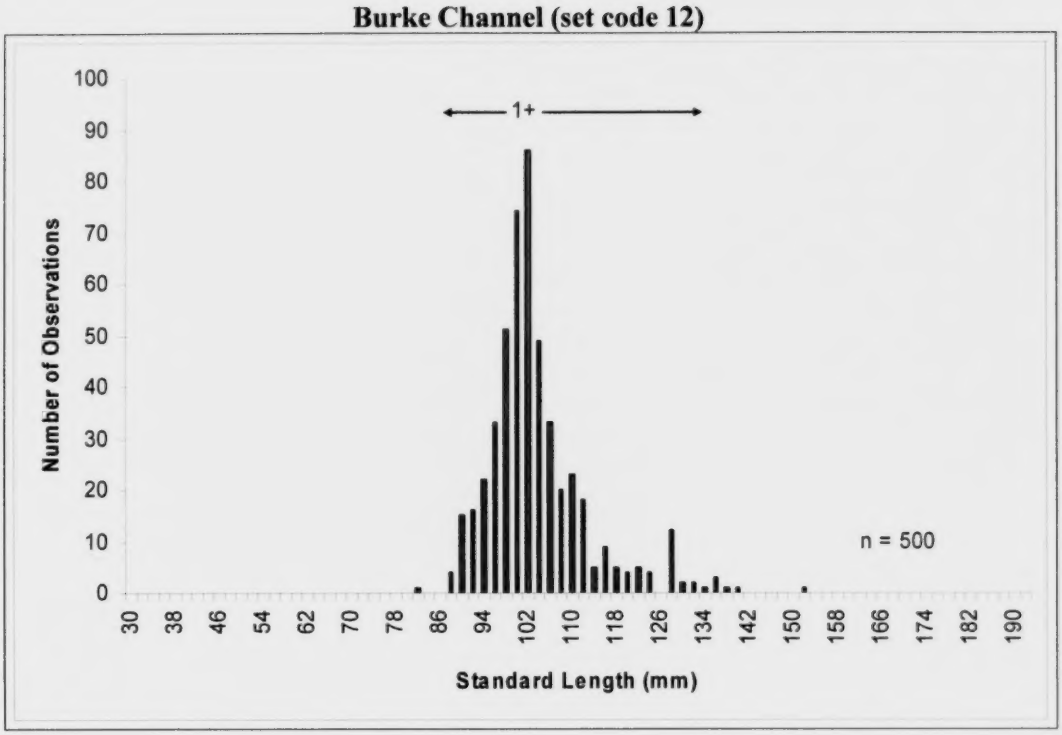


Figure 7…continued



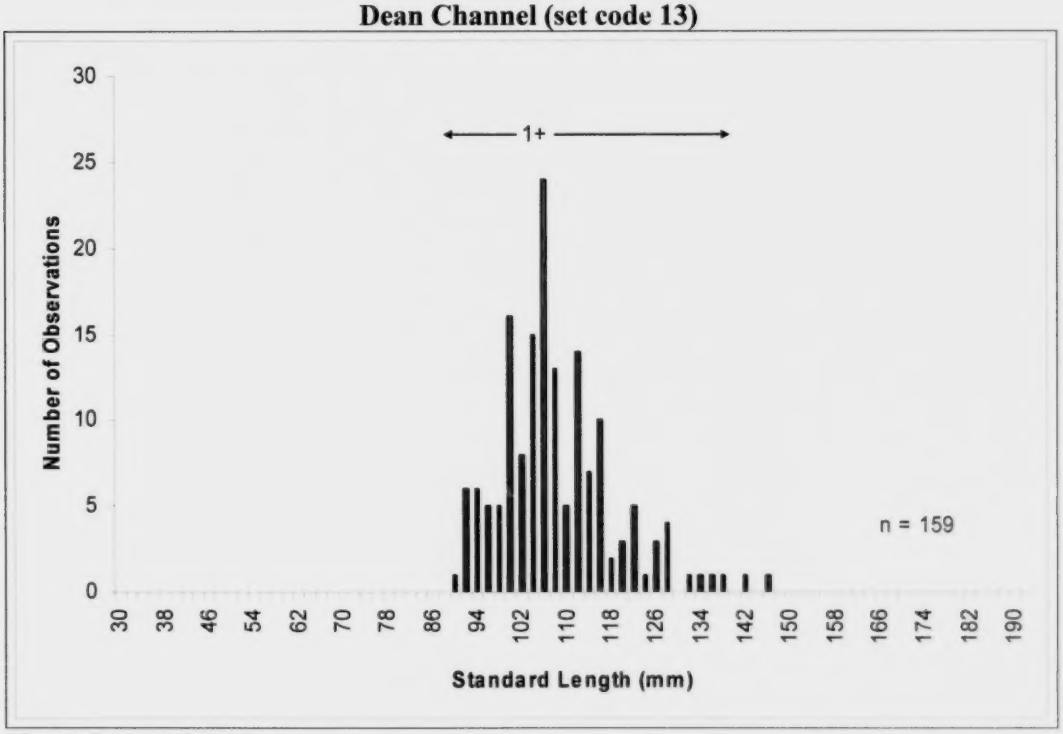


Figure 7…continued

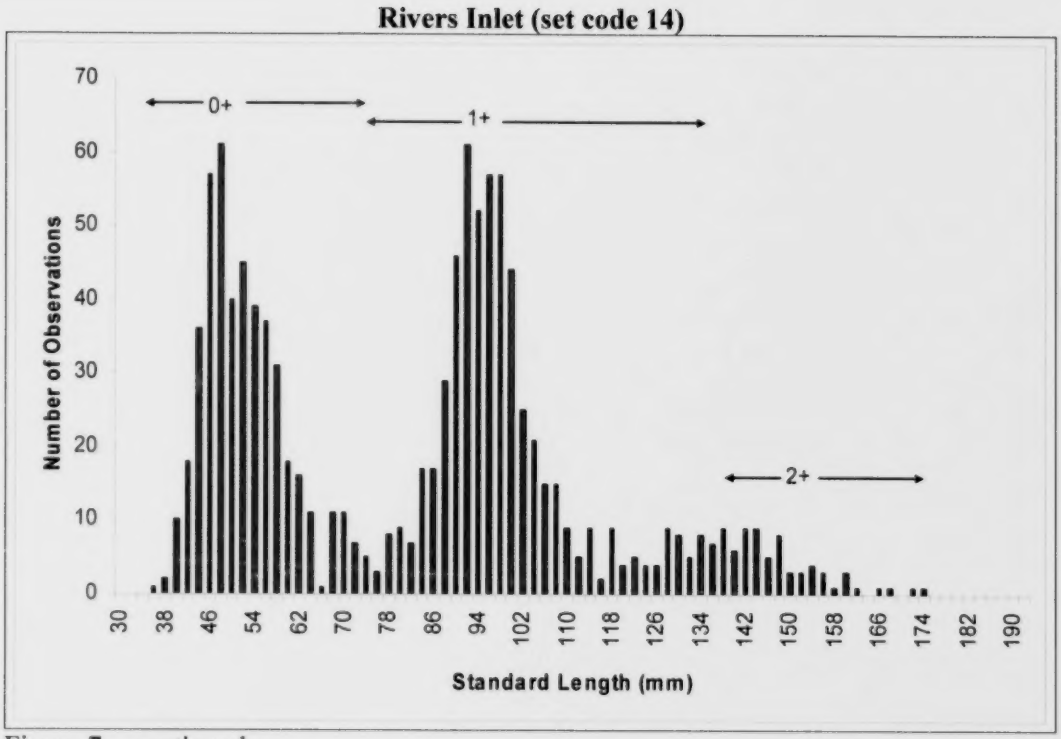


Figure 7…continued

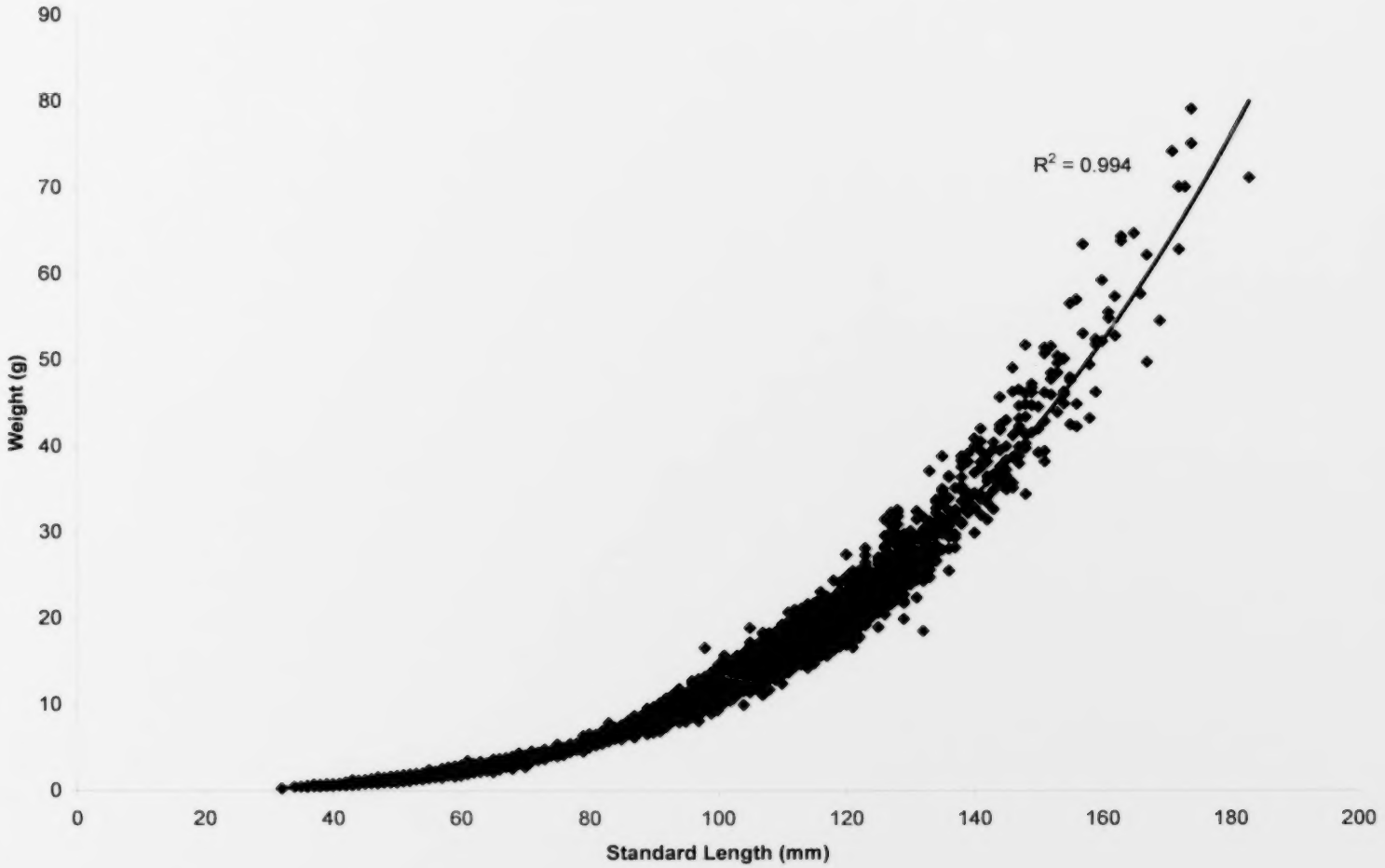


Figure 8. Length-weight relationship for all sampled herring from the 2007 Central Coast juvenile herring survey.

Fish Egg Inlet (set code 1)

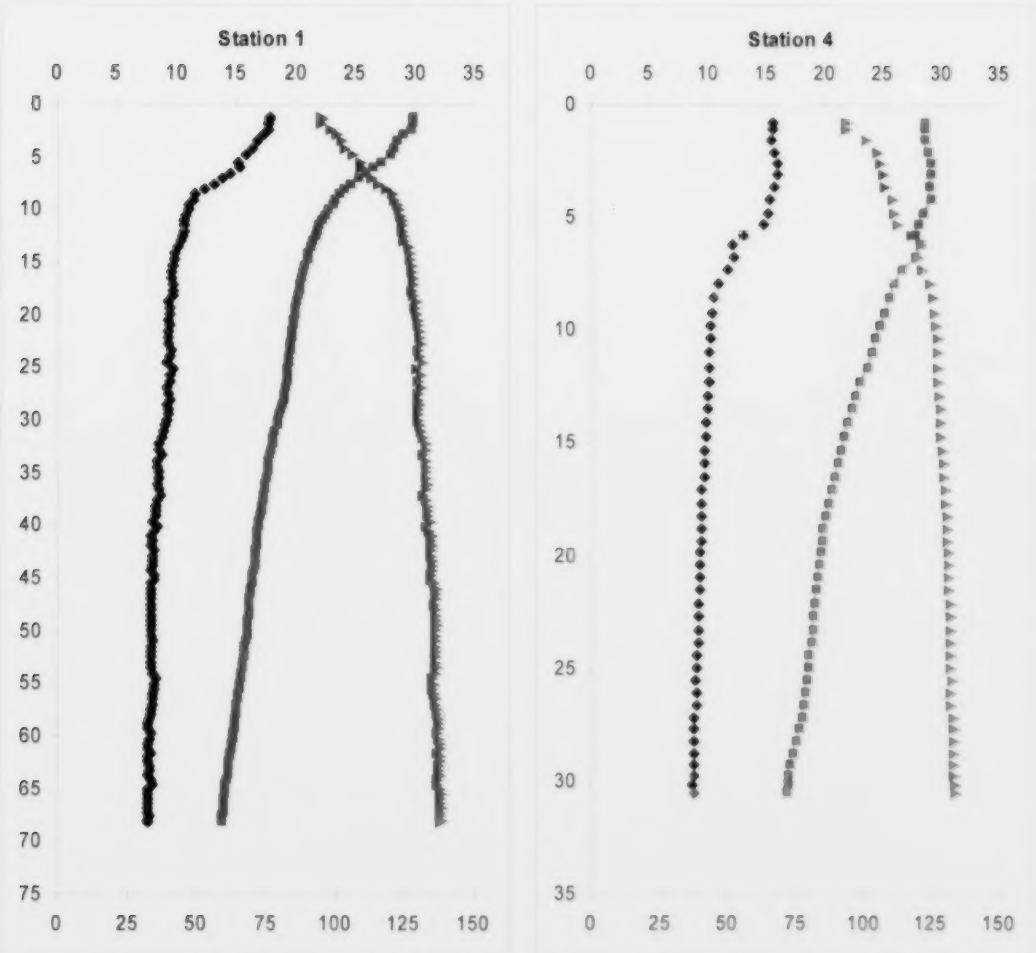


Figure 9. Temperature, salinity and dissolved oxygen profiles from CTD casts during the 2007 Central Coast juvenile herring survey.

Kwakshua Channel (set code 2)

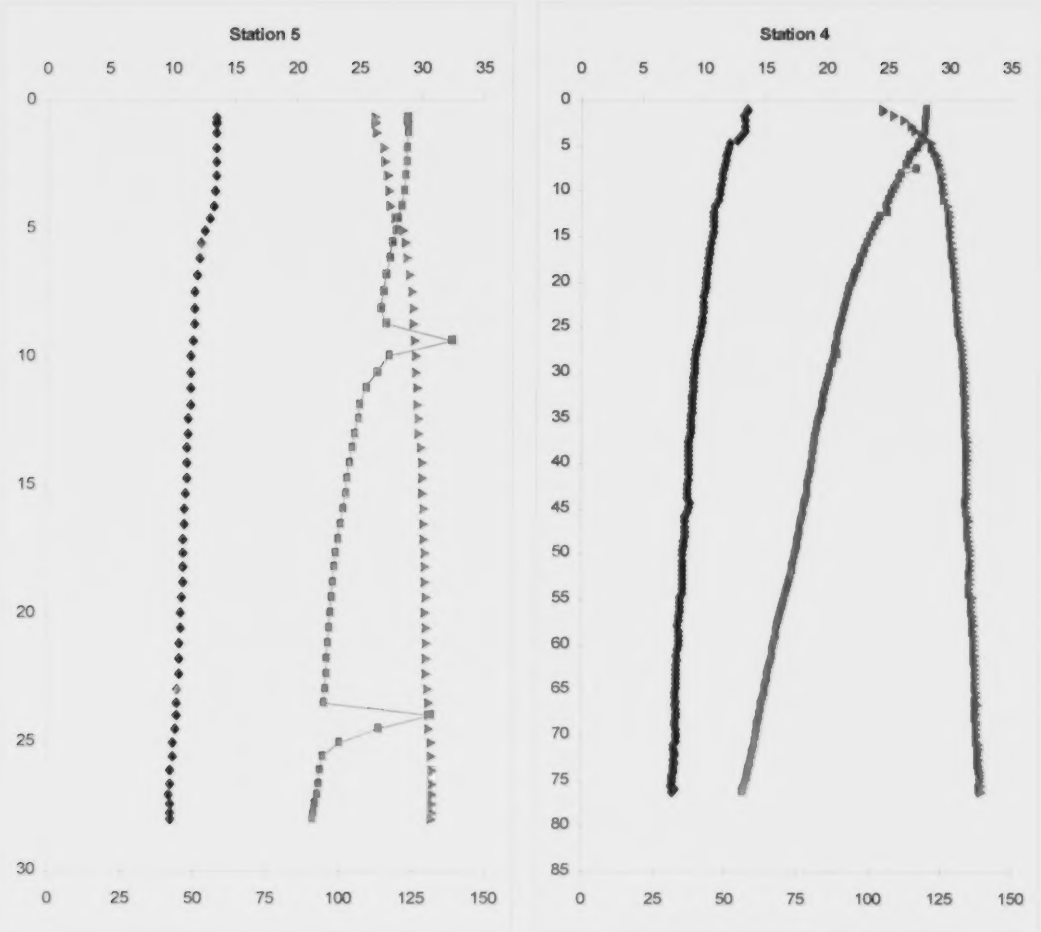


Figure 9 continued…

Kildidt Sound (set code 4)

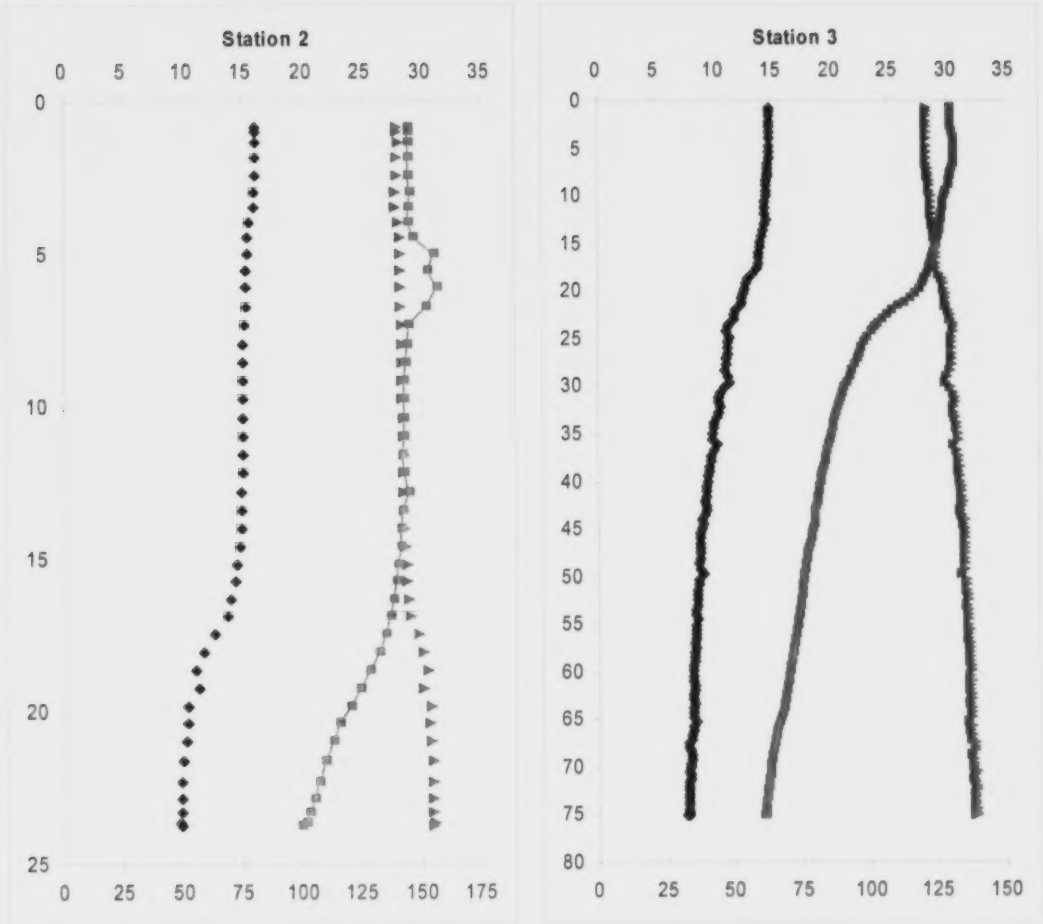


Figure 9 continued…

Thompson Bay (set code 5)

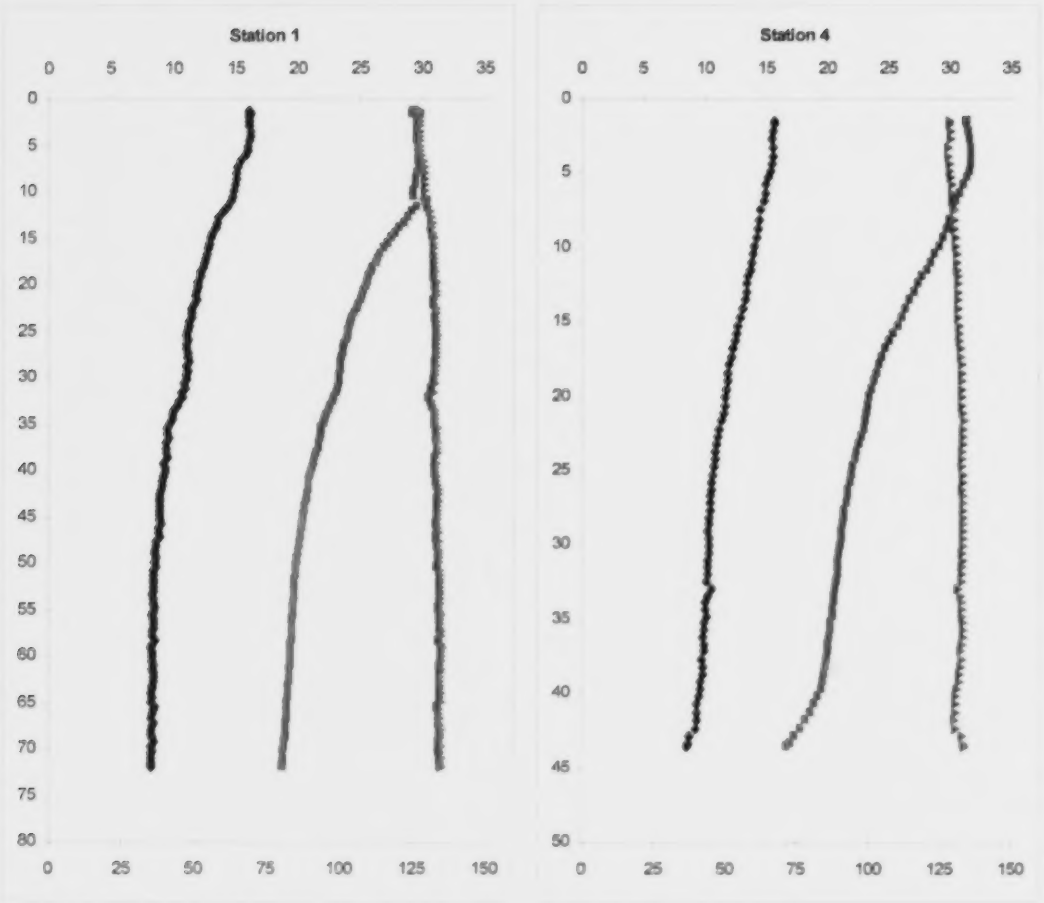


Figure 9 continued…

Meyers Passage (set code 6)

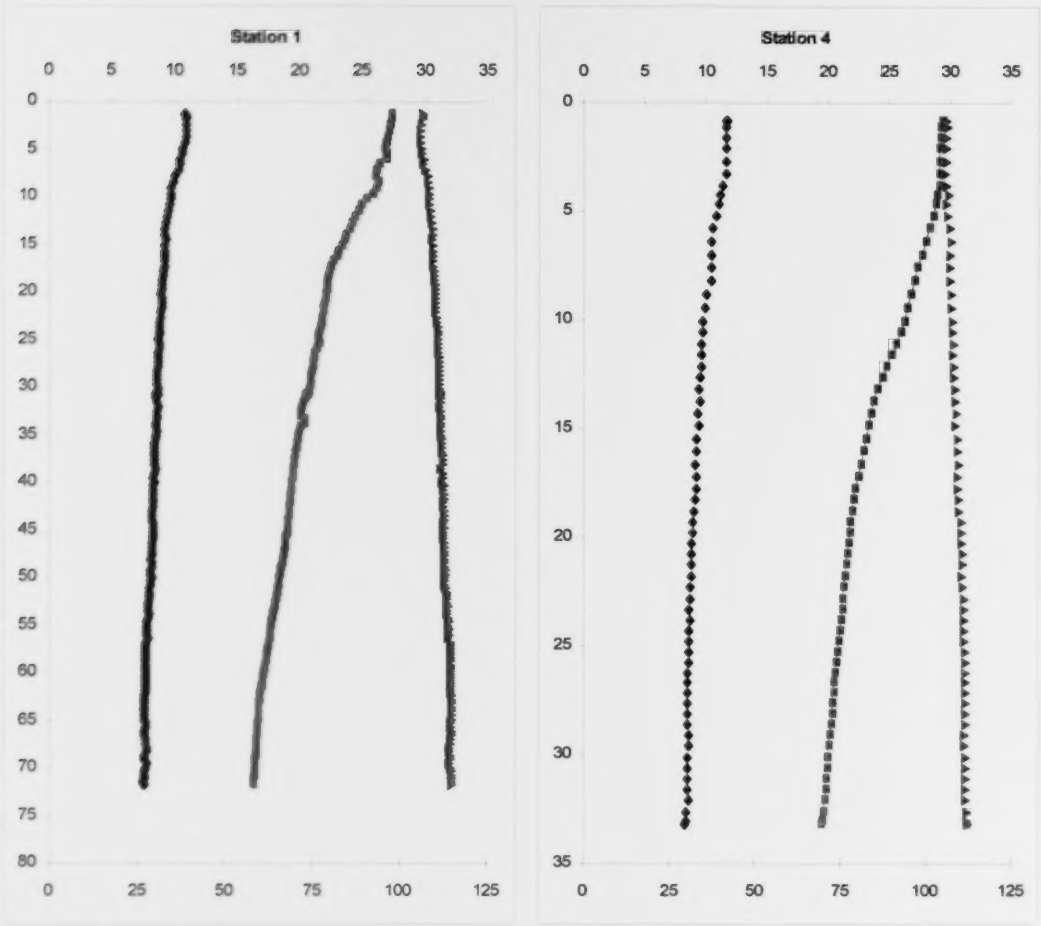


Figure 9 continued…

Kitasu Bay (set code 7)

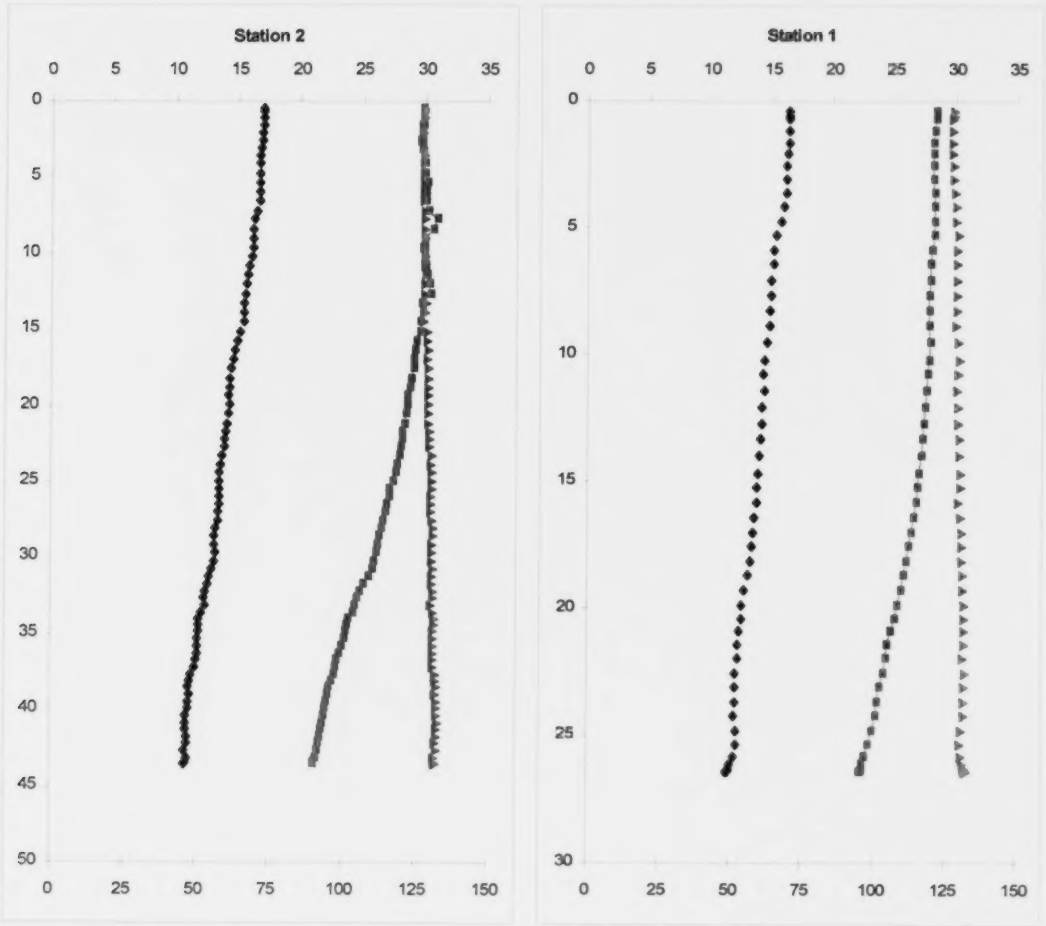


Figure 9 continued…

East Higgins Pass (set code 8)

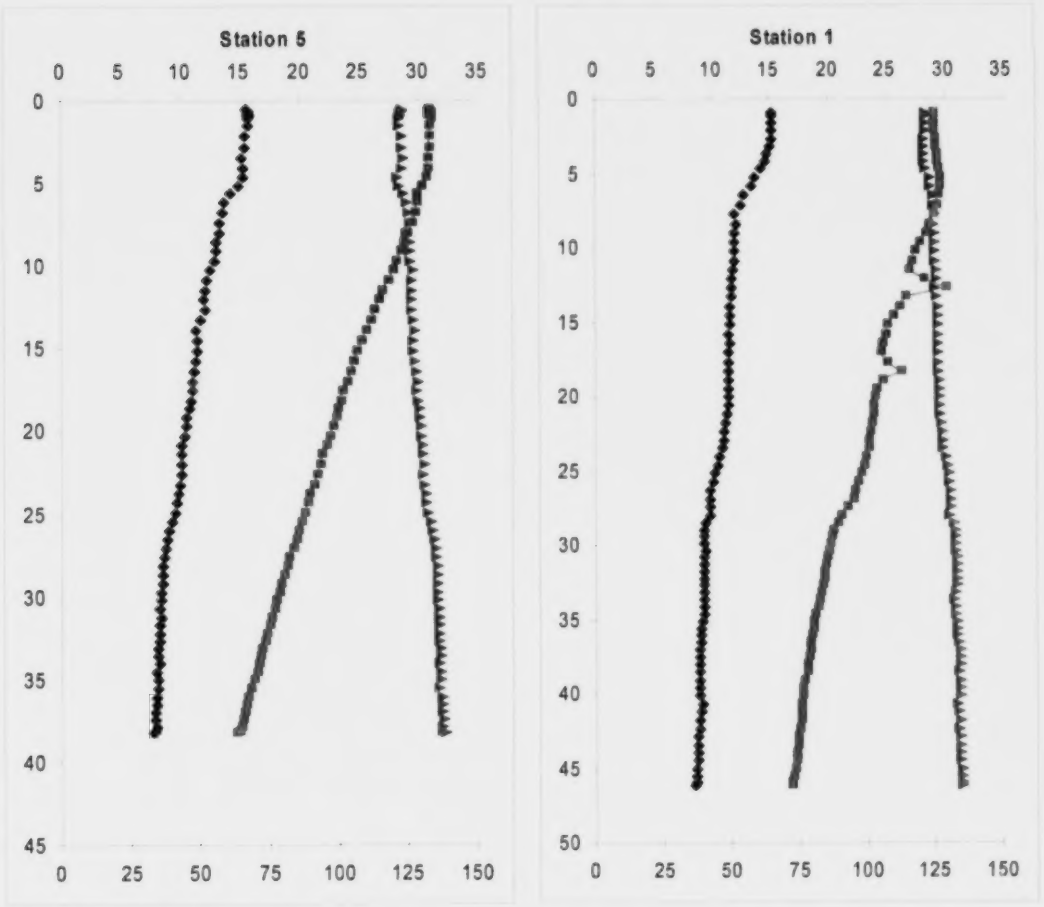


Figure 9 continued…

Powell Anchorage (set code 9)

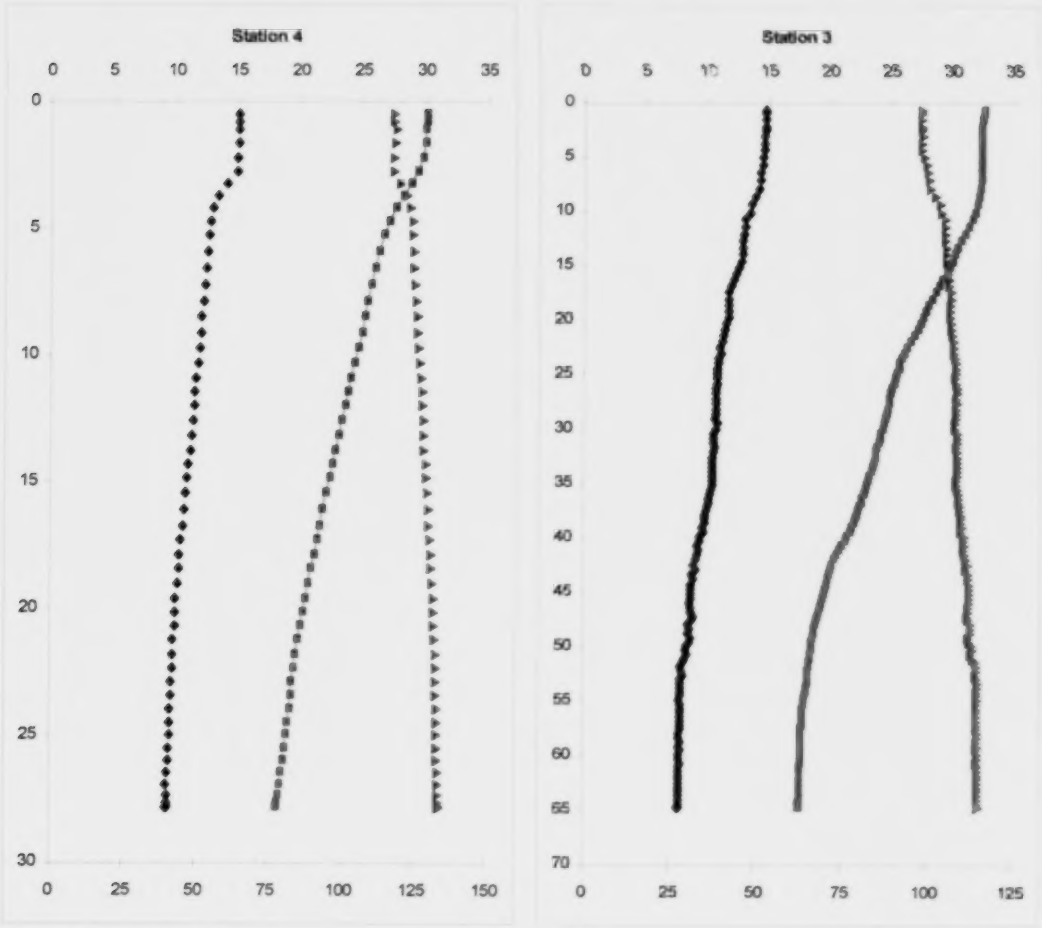


Figure 9 continued…

Spiller Channel (set code 10)

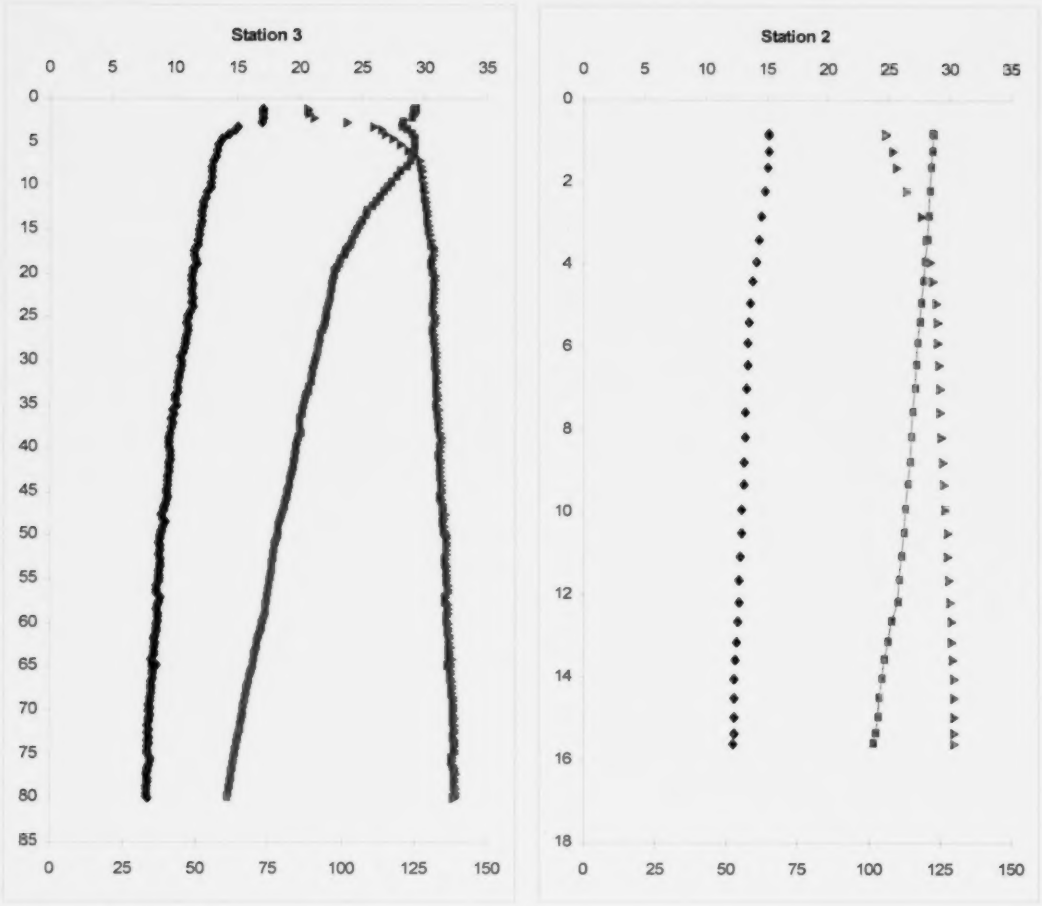


Figure 9 continued…

Hunter Channel (set code 11)

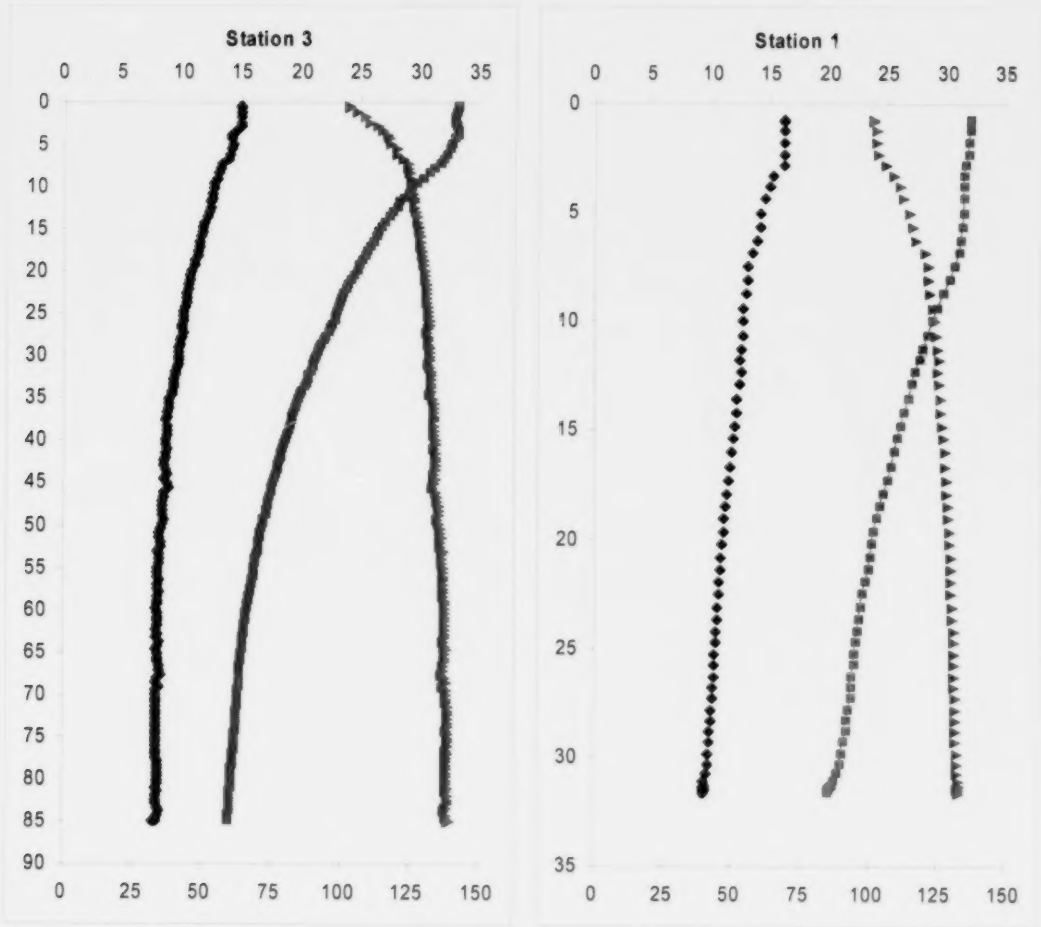


Figure 9 continued…

Burke Channel (set code 12)

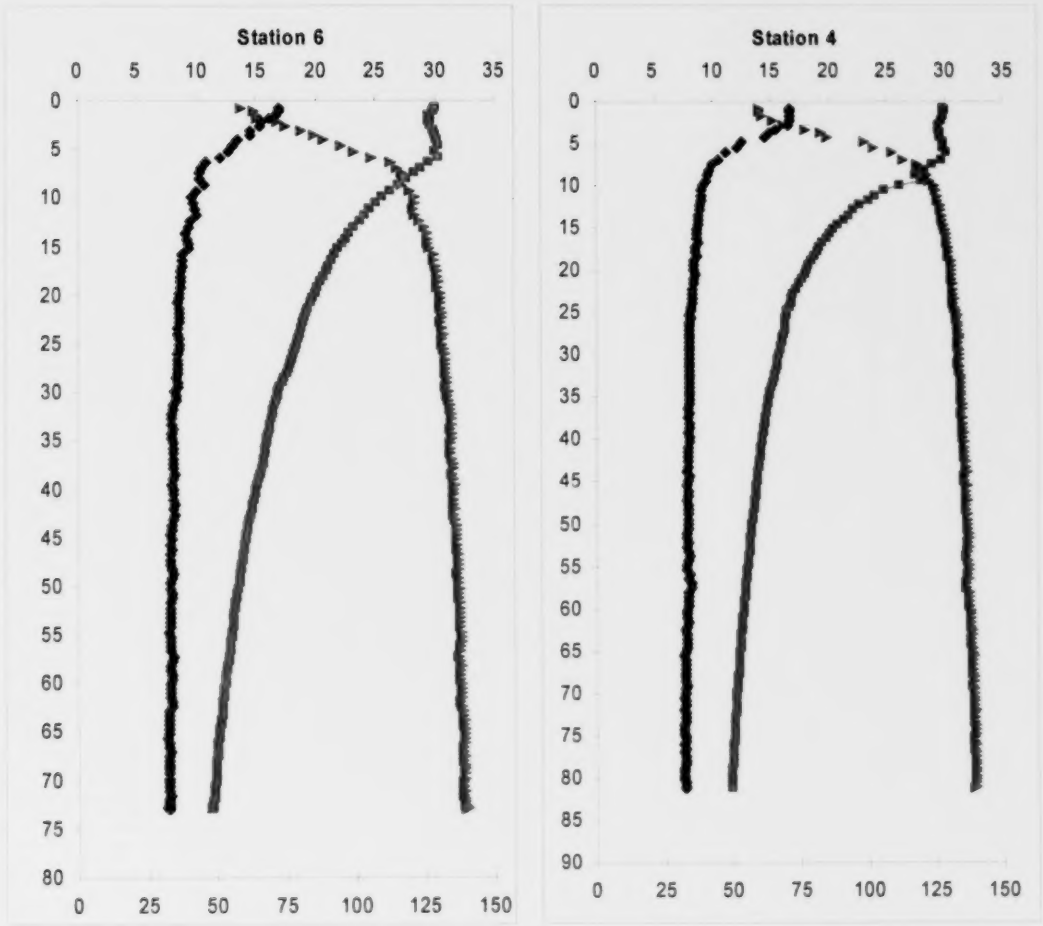


Figure 9 continued…

Dean Channel (set code 13)

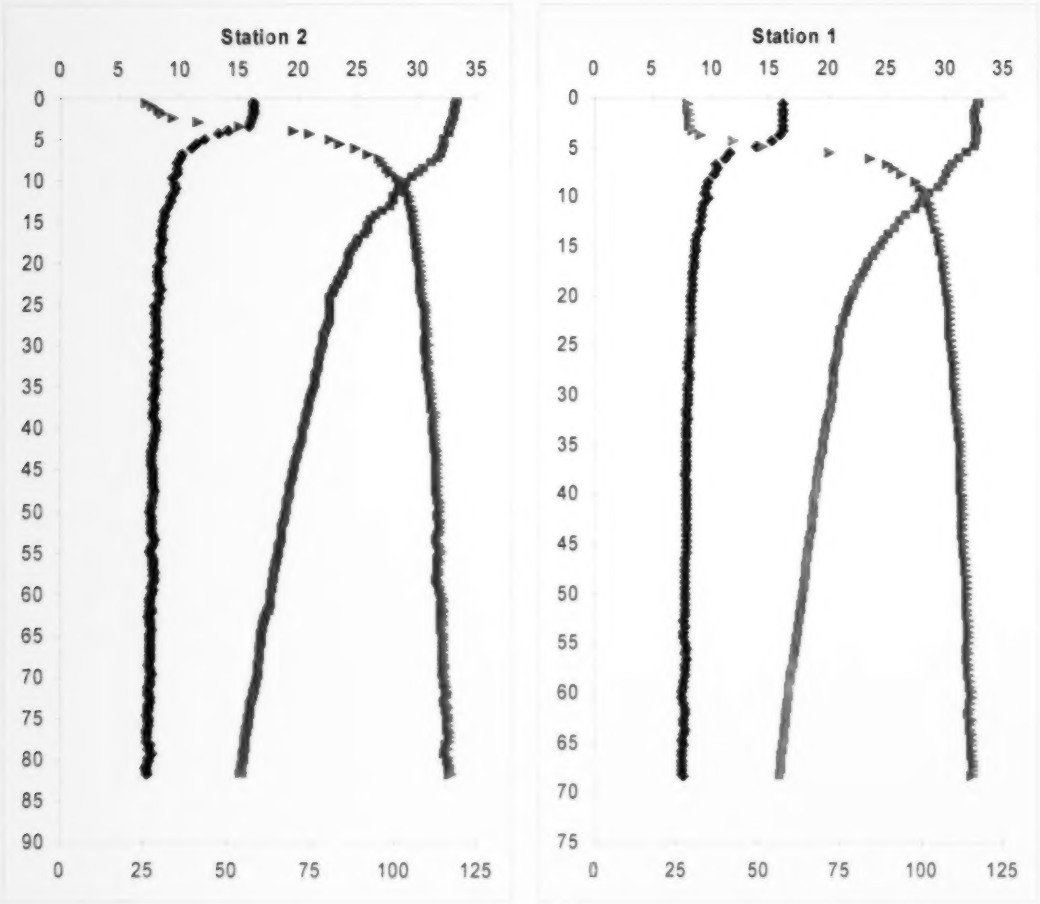


Figure 9 continued…

Rivers Inlet (set code 14)

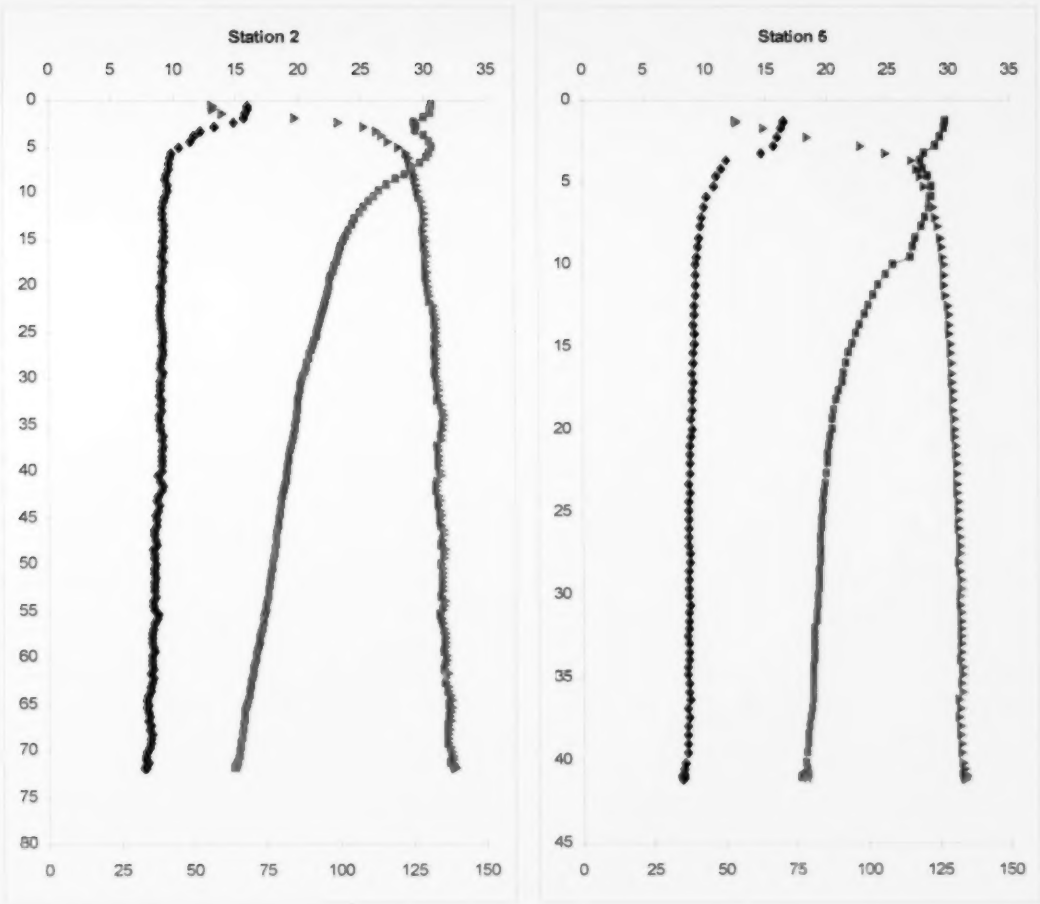


Figure 9 continued…

Table 1. Summary of the purse seine set locations from the 2007 Central Coast juvenile herring survey.

Set	Year	Month	Set Day	Location Name	Set Code	Station	Set Start Time	DD Lat (N)	DD Long (W)
1	2007	8	10	Fish Egg Inlet	1	1	2210	51.621	127.745
2	2007	8	10	Fish Egg Inlet	1	2	2255	51.604	127.773
3	2007	8	10	Fish Egg Inlet	1	5	2335	51.632	127.777
4	2007	8	10	Fish Egg Inlet	1	3	0040	51.617	127.832
5	2007	8	10	Fish Egg Inlet	1	4	125	51.647	127.828
6	2007	8	11	Kwakshua Channel	2	5	2210	51.691	128.077
7	2007	8	11	Kwakshua Channel	2	1	2250	51.676	128.088
8	2007	8	11	Kwakshua Channel	2	4	2340	51.655	128.115
9	2007	8	11	Kwakshua Channel	2	3	0045	51.648	128.091
10	2007	8	11	Kwakshua Channel	2	2	125	51.655	128.053
11	2007	8	12	Kildidt Sound	4	3	2210	51.837	128.154
12	2007	8	12	Kildidt Sound	4	4	2250	51.850	128.116
13	2007	8	12	Kildidt Sound	4	5	2340	51.873	128.132
14	2007	8	12	Kildidt Sound	4	1	0010	51.862	128.146
15	2007	8	12	Kildidt Sound	4	2	0045	51.879	128.159
16	2007	8	13	Thompson Bay	5	1	2210	52.121	128.407
17	2007	8	13	Thompson Bay	5	2	2245	52.134	128.378
18	2007	8	13	Thompson Bay	5	3	2320	52.148	128.398
19	2007	8	13	Thompson Bay	5	5	2345	52.159	128.390
20	2007	8	13	Thompson Bay	5	4	0030	52.159	128.354
21	2007	8	14	East Higgins Pass	8	1	2235	52.402	128.558
22	2007	8	14	East Higgins Pass	8	2	2320	52.436	128.595
23	2007	8	14	East Higgins Pass	8	3	0005	52.471	128.638
24	2007	8	14	East Higgins Pass	8	5	0045	52.492	128.661
25	2007	8	14	East Higgins Pass	8	4	120	52.492	128.693
26	2007	8	15	Kitasu Bay	7	1	2225	52.550	128.800
27	2007	8	15	Kitasu Bay	7	2	2255	52.545	128.771
28	2007	8	15	Kitasu Bay	7	5	2330	52.555	128.751
29	2007	8	15	Kitasu Bay	7	3	0000	52.541	128.742
30	2007	8	15	Kitasu Bay	7	4	0040	52.525	128.751
31	2007	8	16	Meyers Passage	6	4	2210	52.665	128.562
32	2007	8	16	Meyers Passage	6	3	2235	52.673	128.572
33	2007	8	16	Meyers Passage	6	1	2300	52.684	128.577
34	2007	8	16	Meyers Passage	6	2	2330	52.673	128.599
35	2007	8	16	Meyers Passage	6	5	0010	52.655	128.576
36	2007	8	17	Powell Anchorage	9	3	2200	52.321	128.378
37	2007	8	17	Powell Anchorage	9	4	2230	52.326	128.344
38	2007	8	17	Powell Anchorage	9	5	2310	52.312	128.359
39	2007	8	17	Powell Anchorage	9	1	2345	52.291	128.376
40	2007	8	17	Powell Anchorage	9	2	0015	52.284	128.355
41	2007	8	18	Spiller Channel	10	2	2210	52.268	128.271
42	2007	8	18	Spiller Channel	10	3	2240	52.277	128.235

Table 1 continued…

Set	Year	Month	Set Day	Location Name	Set Code	Station	Set Start Time	DD Lat (N)	DD Long (W)
43	2007	8	18	Spiller Channel	10	4	2310	52.290	128.259
44	2007	8	18	Spiller Channel	10	1	0000	52.250	128.274
45	2007	8	18	Spiller Channel	10	5	0050	52.263	128.336
46	2007	8	19	Hunter Channel	11	1	2200	52.057	128.115
47	2007	8	19	Hunter Channel	11	2	2235	52.057	128.141
48	2007	8	19	Hunter Channel	11	5	2300	52.066	128.159
49	2007	8	19	Hunter Channel	11	3	2330	52.073	128.135
50	2007	8	19	Hunter Channel	11	4	0000	52.078	128.153
51	2007	8	20	Dean Channel	13	1	2200	52.318	127.597
52	2007	8	20	Dean Channel	13	2	2225	52.306	127.582
53	2007	8	20	Dean Channel	13	3	2300	52.300	127.553
54	2007	8	20	Dean Channel	13	4	2330	52.314	127.540
55	2007	8	20	Dean Channel	13	5	0000	52.330	127.535
56	2007	8	21	Burke Channel	12	4	2200	52.172	127.573
57	2007	8	21	Burke Channel	12	6	2230	52.182	127.532
58	2007	8	21	Burke Channel	12	3	2310	52.169	127.495
59	2007	8	21	Burke Channel	12	2	2355	52.124	127.438
60	2007	8	21	Burke Channel	12	5	0035	52.105	127.403
61	2007	8	22	Rivers Inlet	14	5	2200	51.565	127.589
62	2007	8	22	Rivers Inlet	14	3	2235	51.592	127.568
63	2007	8	22	Rivers Inlet	14	4	2300	51.572	127.575
64	2007	8	22	Rivers Inlet	14	2	2335	51.580	127.549
65	2007	8	22	Rivers Inlet	14	1	0005	51.557	127.555

Table 2. Summary of the number and weight by species, transect, and station for 2007 Central Coast juvenile herring survey.

Set	Set Code	Station	Location Name	Species	Number	Weight (kg)*
1	1	1	Fish Egg Inlet	**Pacific herring age-0+**	702	1.88
				Pacific herring age-1+	411	4.32
				Northern anchovy	678	8.40
				Three-spine stickleback	60	0.04
				Juvenile pollock	27	0.80
				Chinook salmon	3	0.28
2	1	2	Fish Egg Inlet	**Pacific herring age-0+**	496	1.51
				Pacific herring age-1+	317	3.29
				Sandlance	56	0.04
				Northern anchovy	10	0.14
				Chinook salmon	7	0.31
				Three-spine stickleback	4	0.00
				Juvenile pollock	2	0.04
				Juvenile rockfish	1	0.05
3	1	5	Fish Egg Inlet	**Pacific herring age-0+**	106	0.21
				Pacific herring age-1+	242	3.92
				Pacific herring age-2+	1	0.03
				Pacific sardine	18	2.45
				Chinook salmon	1	0.08
				Pink salmon	1	0.06
				Juvenile pollock	1	0.08
4	1	3	Fish Egg Inlet	**Pacific herring age-0+**	2355	4.62
				Pacific herring age-1+	1860	17.46
				Pacific sardine	625	87.50
5	1	4	Fish Egg Inlet	**Pacific herring age-0+**	1312	3.01
				Pacific herring age-1+	4912	55.20
				Northern anchovy	1120	15.63
				Three-spine stickleback	448	0.53
				Chinook salmon	192	4.78
				Pink salmon	32	0.20
				Shiner perch	32	0.38
6	2	5	Kwakshua Channel	**Pacific herring age-0+**	1575	4.25
				Pacific herring age-1+	2520	46.00
				Pacific sardine	539	75.46
7	2	1	Kwakshua Channel	**Pacific herring age-1+**	1079	20.66
				Pacific herring age-2+	39	1.62
				Pacific sardine	2041	285.74

* Weights ≤ 9g referred to as trace

Table 2 continued…

Set	Set Code	Station	Location Name	Species	Number	Weight (kg)*
8	2	4	Kwakshua Channel	**Pacific herring age-0+**	3069	1.79
				Pacific herring age-1+	195	3.53
				Pacific herring age-2+	3	0.14
				Chinook salmon	3	0.22
				Coho salmon	1	1.70
				Pink salmon	1	1.35
9	2	3	Kwakshua Channel	**Pacific herring age-0+**	714	1.00
				Pacific herring age-1+	1115	20.00
				Pacific sardine	7000	980.00
10	2	2	Kwakshua Channel	**Pacific herring age-0+**	4452	3.07
				Pacific herring age-1+	588	11.20
				Juvenile pollock	48	3.62
				Northern anchovy	6	0.07
				Chinook salmon	2	8.31
				Pink salmon	1	1.45
11	4	3	Kildidt Sound	**Pacific herring age-0+**	1	trace
				Pacific herring age-1+	1	0.02
				Pacific sardine	7143	1000.00
12	4	4	Kildidt Sound	**Pacific herring age-0+**	984	2.50
				Pacific herring age-1+	183	2.50
				Pacific sardine	5321	745.00
13	4	5	Kildidt Sound	**Pacific herring age-0+**	91	0.18
				Pacific herring age-1+	149	2.36
				Squid	43	0.51
				Juvenile rockfish	2	0.03
				Northern anchovy	1	0.01
				Shiner perch	1	trace
14	4	1	Kildidt Sound	**Pacific herring age-0+**	180	0.37
				Pacific herring age-1+	150	2.67
				Pacific herring age-2+	45	2.14
				Pacific sardine	108	15.08
				Squid	22	0.31
				Juvenile pollock	2	0.09
				Chinook salmon	1	0.09
				Northern anchovy	1	0.01
				Pink salmon	1	0.05
15	4	2	Kildidt Sound	Pacific sardine	1429	2000.00

Table 2 continued...

Set	Set Code	Station	Location Name	Species	Number	Weight (kg)*
16	5	1	Thompson Bay	**Pacific herring age-0+**	2	trace
				Pacific herring age-1+	13	0.31
				Squid	14	0.25
				Pacific sardine	1	0.12
17	5	2	Thompson Bay	**Pacific herring age-0+**	3	trace
				Pacific herring age-1+	15	0.28
				Pacific sardine	465	65.10
18	5	3	Thompson Bay	**Pacific herring age-1+**	2	trace
				Pacific sardine	228	31.92
				Squid		6.00
19	5	5	Thompson Bay	**Pacific herring age-0+**	2	trace
				Pacific herring age-1+	3	0.04
				Juvenile rockfish	1	0.03
				Northern anchovy	1	0.02
20	5	4	Thompson Bay	**Pacific herring age-0+**	1038	3.22
				Pacific herring age-1+	1	trace
21	8	1	East Higgins Pass	**Pacific herring age-1+**	1	0.02
				Pacific sardine	7143	1000.00
22	8	2	East Higgins Pass	**Pacific herring age-0+**	3814	4.50
				Pacific herring age-1+	766	20.50
				Pacific sardine	1607	225.00
23	8	3	East Higgins Pass	**Pacific herring age-0+**	1004	0.94
				Pacific herring age-1+	15	0.33
				Pacific sardine	1607	225.00
24	8	5	East Higgins Pass	**Pacific herring age-0+**	320	0.28
				Pacific herring age-1+	116	2.28
				Pacific herring age-2+	2	0.07
				Pacific sardine	278	38.92
				Juvenile pollock	4	0.01
				Northern anchovy	1	0.01
				Chub mackeral	1	0.20
25	8	4	East Higgins Pass	**Pacific herring age-0+**	3488	3.52
				Pacific herring age-1+	1392	26.69
				Pacific sardine	100	15.00

Table 2 continued...

Set	Set Code	Station	Location Name	Species	Number	Weight (kg)*
26	7	1	Kitasu Bay	**Pacific herring age-0+**	32	0.10
				Pacific herring age-1+	50	0.98
				Pacific herring age-2+	2	0.07
				Pacific saury	40	0.32
				Squid	23	0.38
27	7	2	Kitasu Bay	**Pacific herring age-0+**	2	trace
				Pacific herring age-1+	8	0.15
				Pacific herring age-2+	2	0.08
				Pacific sardine	1786	250.00
				Pacific saury	1	trace
28	7	5	Kitasu Bay	**Pacific herring age-0+**	350	0.74
				Pacific herring age-1+	18	0.30
				Pacific sardine	714	100.00
				Chinook salmon	1	0.21
				Pacific saury	1	trace
29	7	3	Kitasu Bay	**Pacific herring age-0+**	82	0.23
				Pacific herring age-1+	81	1.41
				Pacific sardine	357	50.00
30	7	4	Kitasu Bay	**Pacific herring age-0+**	1	trace
				Pacific herring age-1+	18	0.33
				Pacific sardine	714	100.00
31	6	4	Meyers Passage	**Pacific herring age-0+**	93	0.25
				Pacific herring age-1+	89	1.57
				Three-spine stickleback	2	trace
				Juvenile pollock	1	trace
32	6	3	Meyers Passage	**Pacific herring age-0+**	31	0.08
				Pacific herring age-1+	24	0.39
				Northern anchovy	1	0.01
				Chum salmon	1	4.00
				Pacific sardine	1	0.13
33	6	1	Meyers Passage	**Pacific herring age-0+**	62	0.09
				Pacific herring age-1+	5	0.08
				Pacific sardine	4	0.51
34	6	2	Meyers Passage	Pink salmon	100	200.00
35	6	5	Meyers Passage	**Pacific herring age-0+**	3396	3.90
				Pacific herring age-1+	2160	44.05
				Three-spine stickleback	12	0.09

Table 2 continued...

Set	Set Code	Station	Location Name	Species	Number	Weight (kg)*
36	9	3	Powell Anchorage	**Pacific herring age-0+**	21	0.03
				Pacific herring age-1+	39	0.76
				Pacific herring age-2+	7	0.39
				Pacific sardine	1	0.14
37	9	4	Powell Anchorage	**Pacific herring age-0+**	17865	25.36
38	9	5	Powell Anchorage	**Pacific herring age-0+**	93	0.16
				Pacific herring age-1+	3	0.05
				Three-spine stickleback	3	trace
				Shiner perch	1	trace
39	9	1	Powell Anchorage	**Pacific herring age-0+**	126	0.22
				Pacific herring age-1+	10	0.17
				Squid	8	0.12
				Shiner perch	6	0.04
				Juvenile rockfish	1	0.03
				Pacific sardine	1	0.15
40	9	2	Powell Anchorage	**Pacific herring age-0+**	37	0.06
				Pacific herring age-1+	2	0.03
				Pacific sardine	357	50.00
				Northern anchovy	3	0.04
				Shiner perch	1	trace
				Three-spine stickleback	1	trace
41	10	2	Spiller Channel	**Pacific herring age-1+**	11395	213.89
42	10	3	Spiller Channel	**Pacific herring age-1+**	69	1.50
				Pacific sardine	75	10.95
43	10	4	Spiller Channel	**Pacific herring age-0+**	60	0.26
				Pacific herring age-1+	1356	26.98
44	10	1	Spiller Channel	**Pacific herring age-0+**	1	trace
				Pacific herring age-1+	14	0.33
				Pacific herring age-2+	1	0.04
				Pacific sardine	50	6.70
				Northern anchovy	1	0.03
				Chum salmon	1	3.50
45	10	5	Spiller Channel	**Pacific herring age-0+**	2	trace
				Pacific herring age-1+	15	0.30
				Pacific sardine	50	7.20
				Chub mackeral	1	0.21
				Shiner perch	1	trace

Table 2 continued…

Set	Set Code	Station	Location Name	Species	Number	Weight (kg)*
46	11	1	Hunter Channel	**Pacific herring age-0+**	11712	30.44
				Pacific herring age-1+	2124	33.05
				Juvenile pollock	60	2.82
47	11	2	Hunter Channel	**Pacific herring age-0+**	4524	11.27
				Pacific herring age-1+	354	4.83
				Pacific sardine	78	10.83
48	11	5	Hunter Channel	**Pacific herring age-0+**	192	0.56
				Pacific herring age-1+	11	0.18
				Pacific sardine	536	75.00
49	11	3	Hunter Channel	**Pacific herring age-0+**	28	0.08
				Pacific herring age-1+	27	0.42
				Pacific herring age-2+	2	0.07
				Pacific sardine	536	75.00
50	11	4	Hunter Channel	Pacific sardine	14286	2000.00
51	13	1	Dean Channel	**Pacific herring age-1+**	36	0.74
				Juvenile pollock	2	0.08
				Three-spine stickleback	2	trace
				Northern anchovy	1	0.01
52	13	2	Dean Channel	**Pacific herring age-1+**	12	0.21
				Pacific sardine	279	39.06
				Three-spine stickleback	6	trace
				Northern anchovy	3	trace
				Sandlance	2	trace
53	13	3	Dean Channel	**Pacific herring age-1+**	196	3.00
				Pacific herring age-2+	2	0.09
				Three-spine stickleback	132	0.12
				Northern anchovy	14	0.22
				Chinook salmon	4	0.08
				Pink salmon	1	1.60
54	13	4	Dean Channel	Pacific sardine	2142	300.00
55	13	5	Dean Channel	**Pacific herring age-1+**	16	0.23
				Pacific sardine	2142	300.00

Table 2 continued...

Set	Set Code	Station	Location Name	Species	Number	Weight (kg)*
56	12	4	Burke Channel	**Pacific herring age-1+**	729	9.56
				Sandlance	36	0.04
				Chinook salmon	6	0.08
				Northern anchovy	3	0.07
				Eulachon	3	0.05
57	12	6	Burke Channel	**Pacific herring age-1+**	858	12.66
				Sandlance	12	0.01
				Northern anchovy	9	0.11
				Chinook salmon	3	0.03
58	12	3	Burke Channel	**Pacific herring age-1+**	696	10.25
				Three-spine stickleback	15	0.03
59	12	2	Burke Channel	**Pacific herring age-1+**	924	10.67
				Three-spine stickleback	162	0.21
				Northern anchovy	3	0.05
				Chinook salmon	3	0.03
60	12	5	Burke Channel	**Pacific herring age-1+**	466	8.07
				Pacific herring age-2+	2	0.10
				Chum salmon	2	10.00
				Spiny dogfish	1	
61	14	5	Rivers Inlet	**Pacific herring age-0+**	81	0.14
				Pacific herring age-1+	204	2.36
				Sandlance	77	0.07
				Pacific sardine	12	15.82
				Juvenile pollock	10	0.25
				Chinook salmon	6	0.13
62	14	3	Rivers Inlet	**Pacific herring age-0+**	664	1.13
				Pacific herring age-1+	792	2.73
				Pacific herring age-2+	172	7.40
				Juvenile pollock	12	0.12
				Pink salmon	6	12.00
				Chinook salmon	4	0.07
63	14	4	Rivers Inlet	**Pacific herring age-0+**	672	0.88
				Pacific herring age-1+	1384	16.66
				Pacific herring age-2+	16	0.86
				Pacific sardine	228	31.92
				Sandlance	20	0.02
				Juvenile pollock	8	0.28
				Three-spine stickleback	4	trace

Table 2 continued…

Set	Set Code	Station	Location Name	Species	Number	Weight (kg)*
64	14	2	Rivers Inlet	**Pacific herring age-0+**	264	0.46
				Pacific herring age-1+	346	3.87
				Pacific herring age-2+	5	0.24
				Juvenile pollock	8	0.27
				Sandlance	5	trace
				Pacific sardine	5	0.75
				Chinook salmon	1	trace
				Three-spine stickleback	1	trace
65	14	1	Rivers Inlet	**Pacific herring age-0+**	261	0.47
				Pacific herring age-1+	561	5.98
				Pacific herring age-2+	3	0.14
				Pacific sardine	183	25.62
				Juvenile pollock	12	0.33

Table 3. Percent occurrence by species in purse seine sets for the 2007 Central Coast juvenile herring survey.

Species Caught		
Common Name	**Scientific Name**	**% Occurrence**
Pacific herring age-0+	*Clupea pallasi* in year of birth	72.3
Pacific herring age-1+	*Clupea pallasi* in first year	92.3
Pacific herring age-2+	*Clupea pallasi* in second or more years	24.6
Chinook salmon	*Oncorhynchus tshawytscha*	23.1
Chub mackeral	*Scomber japonicus*	3.1
Chum salmon	*Oncorhynchus keta*	4.6
Coho salmon	*Oncorhynchus kisutch*	1.5
Eulachon	*Thaleichthys pacificus*	1.5
Juvenile pollock	*Theragra chalcogramma*	21.5
Juvenile rockfish	*Sebastes sp.*	6.2
Northern anchovy	*Engraulis mordax mordax*	26.2
Pacific sardine	*Sardinops sagax*	61.5
Pacific saury	*Cololabis saira*	4.6
Pink salmon	*Oncorhynchus gorbuscha*	12.3
Sandlance	*Ammodytes hexapterus*	10.8
Shiner perch	*Cymatogaster aggregata*	9.2
Spiny dogfish	*Squalus acanthias*	1.5
Squid	*Loligo opalescens, Gonatus fabricii*	9.2
Three-spine stickleback	*Gasterosteus aculeatus*	21.5

Table 4. Summary of the number of herring sampled, range of length, mean length, range of weight, mean weight, and standard deviations for three herring age classes. Total catch in numbers (N) and weight (Wt) of all herring by transect for the 2007 Central Coast juvenile herring survey.

Age-0+			Length (mm)			Weight (g)				
Location Name	Set Code	Sampled	Range	Mean	STDev	Range	Mean	STDev	Catch	Total Catch Weight (Kg)
Fish Egg Inlet	1	489	44-80	60	6.52	0.90-5.57	2.39	0.85	4971	11.22
Kwakshua Channel	2	323	43-79	54	6.04	0.79-5.14	1.72	0.66	9810	10.11
Kildidt Sound	4	201	43-76	57	5.62	0.85-4.76	2.03	0.61	1256	3.05
Thompson Bay	5	104	55-71	64	3.76	1.82-4.06	3.09	0.50	1045	3.24
Meyers Pass	6	286	36-78	54	10.63	0.38-5.40	1.88	1.28	3582	4.32
Kitasu Bay	7	250	47-80	60	5.84	0.99-6.33	2.29	0.79	467	1.08
East Higgins Pass	8	310	32-71	46	3.98	0.23-3.38	0.95	0.25	8626	9.24
Powell Anchorage	9	376	39-77	51	6.23	0.65-4.88	1.63	0.67	18142	25.84
Spiller Channel	10	13	51-80	68	8.90	1.45-6.12	3.96	1.37	63	0.27
Hunter Channel	11	328	50-80	63	4.88	1.16-6.36	2.69	0.63	16456	42.35
Burke Channel	12	0							0	0.00
Dean Channel	13	0							0	0.00
Rivers Inlet	14	477	36-80	53	9.20	0.37-6.54	1.70	1.10	1942	3.08
Totals		3157	32-80	56	8.60	0.37-6.54	1.97	0.98	66360	113.81

Table 4 continued…

Age-1+			Length (mm)			Weight (g)				
Location Name	**Set Code**	**Sampled**	**Range**	**Mean**	**STDev**	**Range**	**Mean**	**STDev**	**Catch**	**Total Catch Weight (Kg)**
Fish Egg Inlet	1	516	81-134	100	10.23	5.43-28.12	11.51	3.94	7742	84.20
Kwakshua Channel	2	342	92-140	117	8.39	9.24-33.43	18.65	4.13	5497	101.40
Kildidt Sound	4	215	88-140	111	9.59	6.67-33.43	16.90	4.63	483	7.55
Thompson Bay	5	22	83-132	115	10.42	6.34-28.03	18.46	4.53	34	0.67
Meyers Pass	6	218	82-135	115	9.97	5.52-30.38	18.90	4.93	2278	46.08
Kitasu Bay	7	174	96-137	116	8.84	9.10-34.66	18.16	4.58	175	3.17
East Higgins Pass	8	216	89-140	119	8.32	6.51-35.02	19.86	4.63	2290	49.82
Powell Anchorage	9	55	82-134	114	10.00	5.95-32.14	18.50	4.99	54	1.01
Spiller Channel	10	253	83-136	117	7.32	6.97-32.41	19.85	3.63	12849	243.00
Hunter Channel	11	197	86-134	108	7.62	7.37-32.67	15.04	3.44	2516	38.48
Burke Channel	12	499	81-140	103	8.94	5.23-40.73	14.33	4.90	3673	51.21
Dean Channel	13	157	89-137	107	9.61	7.39-36.42	16.30	5.33	260	4.17
Rivers Inlet	14	566	81-140	100	13.54	5.73-39.80	12.53	6.75	3287	31.60
Totals		3430	81-140	108	12.31	5.23-40.73	15.66	5.73	41138	662.37

Table 4 continued…

Age-2+			Length (mm)			Weight (g)				
Location Name	Set Code	Sampled	Range	Mean	STDev	Range	Mean	STDev	Catch	Total Catch Weight (Kg)
Fish Egg Inlet	1	1	142	142	0	33.36	33.36	0	1	0.03
Kwakshua Channel	2	4	150-159	154	4.11	39.13-47.84	43.10	4.55	42	1.76
Kildidt Sound	4	45	141-174	153	8.58	34.75-74.95	47.61	8.75	45	2.14
Thompson Bay	5	1	163	163	0	64.19	64.19	0	1	0.06
Meyers Pass	6	0							0	0.00
Kitasu Bay	7	4	142-156	148	6.03	33.94-44.76	38.43	4.55	4	0.15
East Higgins Pass	8	2	143-146	145	2.12	35.03-36.12	35.58	0.77	2	0.07
Powell Anchorage	9	7	147-183	161	12.92	42.76-71.02	56.21	11.71	7	0.39
Spiller Channel	10	1	145	145	0	36.43	36.43	0	1	0.04
Hunter Channel	11	2	142-143	143	0.71	32.55-38.05	35.30	3.89	2	0.07
Burke Channel	12	1	151	151	0	51.28	51.28	0	2	0.10
Dean Channel	13	2	142-146	144	2.83	38.77-48.98	43.88	7.22	2	0.09
Rivers Inlet	14	53	141-174	150	7.97	31.35-78.96	44.41	9.86	196	8.65
Totals		123	141-183	151	8.78	31.35-78.96	45.78	9.81	305	13.56

Table 5. Grouping of organisms, by phylum with abbreviations from plankton tows from the 2007 Central Coast juvenile herring survey.

Coelenterata	
COEL	Medusae - *Aequorea victoria*
SIPH	Siphonophores
Ctenophora	
CTEN	Ctenophores
Annelida	
POLY	Polychaetes
Mollusca	
GAST	Prosobranch gastropods
LHEL	*Limacina helicina*
PELE	Pelecypods
Arthropoda	
AMPH	Amphipods
BARN	Barnacle; unknown stage
CLAD	Cladocerans; Podon sp. and Evadne sp.
COPE	Copepods (Table 6 for complete species list)
CRAM	Crab megalopea
CRAZ	Crab zoea
EUPA	Adult euphausiids; mainly *Euphausia pacifica*
EUPL	Larval euphausiids; mainly *Euphausia pacifica*
MYSI	Mysids
OSTR	Ostracods
SEAL	*Caligus elongatus*
SHRI	Shrimp zoea
Ectoprocta	
ECTO	Ectoprocts; mostly *Membranipora sp.* larvae (cyphonautes)
Chaetognatha	
CHAE	Chaetognaths; mostly *Sagitta sp.*
Chordata	
LARV	Larvaceans; mostly *Oikopluera sp.* and *Fritillaria sp.*
FISHL	Larval fish; unknown species
Miscellaneous	
EGGS	Mainly euphausiid eggs, with some teleost eggs

Table 6. Abbreviations for calanoid and cyclopoid copepods identified in plankton samples from the 2007 Central Coast juvenile herring survey.

Calanoid copepods	
ACAR	*Acartia sp.*
ALON	*Acartia longimeres*
CABD	*Centropages abdominalis*
CALA	*Calanus sp.*
CCOL	*Canadacia columbiae*
CMAR	*Calanus marshallae*
CPAC	*Calanus pacificus*
EBUN	*Eucalanus bungii*
EELO	*Eucalanus elongatus*
ELON	*Epilabidocera longipedata*
EUCH	*Euchaeta sp.*
METR	*Metridia sp.*
MPAC	*Metridia pacifica*
MPSE	*Metridia pseudopacfica*
PMIN	*Pseudocalanus minutus*
PPAR	*Paracalanus parvus*
PSEU	*Pseudocalanus sp.*
TDIS	*Tortanus discaudatus*
UCAL	Unidentified calanoids
Cyclopoid copepods	
CANG	*Corycaeus anglicus*
OATL	*Oithona atlantica*
OITH	*Oithona sp.*
OSIM	*Oithona similis*

Table 7. Number of zooplankton per set per m^3 of water observed in samples from the 2007 Central Coast juvenile herring survey.

Location	Set Code	Station	Volume (m^3)	ACAR	ALON	AMPH	BARN	CABD	CALA	CANG	CCOL	CHAE
Fish Egg	1	1	16.1459	-	22.5	1.8	85.3	39.6	3.1	-	-	0.7
	1	4	15.9410	-	116.4	-	82.7	125.5	6.0	-	-	0.1
Kwakshua Channel	2	4	14.7647	-	148.3	3.3	69.7	9.5	14.0	-	-	0.1
	2	5	16.1969	-	203.1	-	60.8	22.3	-	-	-	0.1
Kildidt Sound	4	2	15.5905	-	23.9	0.5	46.6	13.0	-	-	-	0.1
	4	3	19.4904	-	73.9	0.2	57.5	105.7	38.7	-	-	-
Thompson Bay	5	1	15.5471	-	191.4	0.1	6.2	210.8	31.7	-	-	-
Meyers Passage	6	1	16.5573	-	604.8	-	62.0	7.7	-	-	-	-
	6	4	16.6800	-	759.7	0.2	23.2	34.5	0.4	-	-	-
Kitasu Bay	7	1	14.4180	-	705.6	0.1	8.9	4.4	4.2	-	-	0.1
	7	2	13.1526	-	1105.0	0.4	-	29.2	10.2	-	-	-
East Higgins Pass	8	1	17.2536	-	673.6	6.0	51.9	162.5	14.8	-	1.9	1.4
	8	5	12.7282	-	123.8	-	75.4	220.0	-	-	-	0.1
Powell Anchorage	9	3	17.5195	-	213.0	0.1	40.8	68.7	-	-	-	0.1
	9	4	16.9816	-	156.1	-	33.1	20.4	-	-	-	0.1
Spiller Channel	10	2	16.7074	-	114.4	-	16.3	31.4	2.6	-	-	-
	10	3	15.6423	-	247.5	-	16.4	83.9	29.7	-	-	1.5
Hunter Channel	11	1	16.8765	-	241.0	-	42.1	11.0	-	-	-	-
	11	3	16.1733	-	151.1	0.4	19.8	88.4	3.9	-	-	0.5
Burke Channel	12	4	10.5135	48.7	-	-	76.1	-	-	-	-	-
	12	6	11.1550	49.7	-	-	38.8	-	0.2	-	-	-
Dean Channel	13	1	18.6897	87.3	-	-	0.1	-	-	1.7	-	0.1
	13	2	18.0269	88.8	-	-	5.3	3.9	-	-	-	-
Rivers Inlet	14	2	15.5684	-	34.0	-	11.3	-	0.1	-	-	0.1
	14	5	15.9775	-	44.1	-	111.0	-	0.1	-	-	0.1

Table 7 continued…

Set Code	Station	CLAD	CMAR	COEL	CPAC	CRAM	CRAZ	CTEN	EBUN	ECTO	EELO	EGGS	ELON
1	1	358.7	0.1	2.0	0.2	-	12.3	-	-	5.9	-	47.6	-
1	4	321.2	-	2.1	-	0.1	8.5	-	-	12.0	-	0.1	-
2	4	16.3	0.1	0.1	-	-	1.2	-	-	4.3	-	45.5	-
2	5	9.9	-	-	-	-	14.6	-	-	3.0	-	29.7	-
4	2	9.7	-	0.3	-	0.1	15.5	-	-	4.6	-	11.9	-
4	3	32.8	0.2	-	24.6	-	3.9	-	-	13.1	-	70.6	-
5	1	18.5	0.3	-	1.0	-	2.1	-	-	-	-	94.7	-
6	1	23.2	0.2	-	-	-	4.0	-	-	-	-	77.3	-
6	4	69.1	0.1	-	0.1	-	-	-	-	-	-	38.4	-
7	1	35.5	-	0.1	-	-	4.9	-	-	4.4	-	244.1	-
7	2	4.9	0.1	-	-	0.2	0.4	-	-	4.9	-	170.3	-
8	1	37.1	-	-	-	-	8.3	-	-	-	3.7	445.1	-
8	5	27.7	-	-	0.1	0.2	14.3	-	-	2.5	-	15.1	0.1
9	3	339.7	0.2	-	-	0.1	12.2	-	-	-	-	164.4	-
9	4	73.5	-	3.8	-	0.1	12.9	0.1	-	-	-	0.1	-
10	2	148.4	-	0.1	0.1	-	3.5	-	-	11.5	-	135.0	-
10	3	130.9	2.3	-	2.6	-	0.5	-	-	-	-	703.7	-
11	1	64.5	-	0.1	-	0.1	28.9	-	-	-	-	28.4	-
11	3	32.6	0.1	-	0.1	-	5.8	-	-	-	-	44.5	-
12	4	130.9	-	-	-	-	-	-	3.0	-	-	213.1	-
12	6	169.3	-	-	-	-	0.4	-	2.2	-	-	324.2	-
13	1	159.2	-	0.1	0.1	-	-	-	0.4	-	-	30.8	-
13	2	355.0	0.1	0.2	-	-	3.6	-	0.6	-	-	94.1	-
14	2	3.1	-	-	-	-	-	-	0.8	-	-	-	-
14	5	2.0	0.1	-	0.1	-	-	-	0.6	-	-	-	-

Table 7 continued…

Set Code	Station	EUCH	EUPA	EUPL	FISHL	GAST	LARV	LHEL	METR	MPAC	MPSE	MYSI	OATL
1	1	-	1.6	1.3	0.1	-	27.7	-	-	0.6	-	-	-
1	4	-	-	-	-	2.0	70.3	-	-	-	-	0.3	-
2	4	-	-	-	0.4	1.1	17.3	-	14.0	3.3	-	-	-
2	5	-	-	4.9	0.1	-	42.6	-	-	-	-	-	-
4	2	-	-	4.7	-	10.3	17.4	-	-	-	-	0.1	-
4	3	-	50.9	0.2	-	-	8.2	-	-	0.2	-	-	-
5	1	-	-	17.2	-	6.2	30.9	-	-	-	-	-	-
6	1	-	0.1	11.7	0.4	-	19.3	-	-	-	-	-	-
6	4	-	0.2	30.8	0.1	-	15.3	-	-	1.3	-	0.1	-
7	1	-	0.1	22.3	0.1	-	13.3	-	-	-	-	-	-
7	2	-	-	43.9	0.1	-	4.9	-	-	-	-	-	-
8	1	-	2.8	-	0.5	-	-	8.3	-	90.9	-	-	-
8	5	-	-	5.0	0.1	2.5	12.6	-	-	-	-	-	-
9	3	-	0.1	7.3	-	-	-	-	47.5	26.8	-	-	-
9	4	-	-	-	-	3.8	3.8	-	-	0.1	-	-	-
10	2	-	-	8.7	0.1	2.9	1.0	-	-	-	-	-	-
10	3	-	-	2.6	-	-	-	-	-	-	-	0.3	-
11	1	-	-	5.7	-	17.1	15.2	-	-	-	-	-	-
11	3	-	-	9.7	-	9.2	13.8	-	-	-	-	0.1	-
12	4	-	-	14.3	-	-	228.3	-	-	-	-	-	6.1
12	6	-	-	6.2	-	-	46.2	-	-	-	-	-	-
13	1	-	0.4	3.2	0.2	-	0.2	-	-	-	0.1	-	-
13	2	-	-	1.2	0.2	-	-	-	-	-	-	0.1	-
14	2	-	-	-	-	5.1	26.7	-	0.9	-	-	-	-
14	5	0.1	0.4	1.3	-	12.0	4.9	-	-	0.1	-	-	-

Table 7 continued…

Set Code	Station	OITH	OSIM	OSTR	PELE	PMIN	POLY	PPAR	PSEU	SEAL	SHRI	SIPH	TDIS	UCAL
1	1	5.9	-	-	-	-	0.1	-	97.7	-	4.6	19.8	-	-
1	4	-	2.0	-	-	-	-	-	38.1	-	11.4	0.1	14.1	0.1
2	4	-	1.1	0.1	-	-	1.1	-	116.0	-	3.4	0.1	-	-
2	5	-	7.9	-	-	-	0.1	-	20.6	-	0.1	-	-	0.1
4	2	-	-	-	-	-	0.6	2.1	5.3	-	0.5	1.8	5.1	0.1
4	3	-	-	-	-	-	-	24.6	45.0	-	0.2	1.6	-	-
5	1	-	6.2	-	-	-	-	20.6	152.3	-	2.8	-	-	-
6	1	-	-	-	-	-	0.1	-	309.6	-	0.2	-	-	0.1
6	4	-	-	-	-	-	-	19.2	115.1	-	1.3	-	-	-
7	1	-	13.3	-	-	-	-	13.3	151.3	-	1.0	-	-	-
7	2	-	9.7	-	-	58.4	-	29.2	232.6	-	0.8	-	-	0.3
8	1	-	7.4	-	-	-	-	-	937.0	-	0.5	-	-	-
8	5	-	7.5	-	-	-	-	23.3	75.4	-	1.6	2.6	2.5	-
9	3	-	-	-	-	-	3.7	-	28.9	0.1	0.6	-	-	0.1
9	4	-	1.9	-	-	-	3.8	3.8	27.1	-	13.0	-	-	-
10	2	-	34.5	-	1.0	-	1.0	37.7	33.2	0.1	0.4	0.1	-	0.1
10	3	-	-	-	-	-	0.3	57.3	867.4	-	3.8	0.8	-	-
11	1	-	1.9	-	-	-	-	9.5	19.1	0.1	0.6	-	-	0.2
11	3	-	-	-	-	-	-	18.8	39.4	-	1.4	11.1	-	-
12	4	-	15.2	-	-	-	15.2	6.1	30.4	-	0.6	1.5	-	-
12	6	-	10.0	-	-	-	0.9	-	60.8	-	0.5	4.8	-	-
13	1	-	10.3	-	-	-	0.1	-	54.8	-	2.5	0.1	-	-
13	2	-	21.3	-	3.6	-	-	-	61.8	-	0.1	1.3	-	-
14	2	-	3.1	19.5	-	-	20.6	-	67.8	-	-	17.7	-	-
14	5	-	-	6.0	-	-	0.3	-	114.2	-	0.1	16.1	-	-